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A journal of stomatology; devoted to the advancement and dissemination of knowledge pertaining to the teeth and mouth, and to their relations to the body as a whole

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GENERAL ANNOUNCEMENTS

Proceedings of Dental Societies to be Published as Independent Journals Within the Journal of Dental Research

Affiliated dental societies now publish their Proceedings on conditions that make each Society's group of papers, in effect, its own independent journal under the covers of the Journal of Dental Research. Sections may be obtained as reprints, for issuance in separate volumes of Transactions. The import of this development, for the cause of independent professional journalism, will become evident in the successive issues. Information regarding the plan will be given immediately to any society that may request it. All communications regarding the contents of the sections should be addressed to the representatives of the respective societies.

Beginning with this volume the papers published by societies will appear in the main body of the text of each number and will not be segregated at the end in a "section of proceedings." The papers contributed by societies in each number will be regularly listed here.

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Delay in the Publication of this Number

The long delay in the publication of the numbers of this volume has been explained in a circular letter to the subscribers. The effort to publish the delayed volumes for 1924 and 1925 has been discontinued. The numbers of this volume will be brought up to date by giving them the combined year numerals 1924-26.

Important Books Received

The dentist's own book. By C. Edmund Kells, D.D.S., F.A.C.D., 1237 Maison Blanche, New Orleans. 1925: pp. 510; 7 5/8 x 4 5/8 in.; $7.50. C. V. Mosby Company, St. Louis, Mo.

The life and work of James Leon Williams. By George Wood Clapp, D.D.S., 220 West 42nd Street, New York City. With an introduction by C. N. Johnson, M.A., D.D.S., F.A.C.D., President of the American Dental Association, 1925: pp. 299; 7 1/4 x 3 3/4 in. Dentists' Supply Company, New York City.

A SUMMARY OF THE MOST IMPORTANT FINDINGS OF THE CALIFORNIA STOMATOLOGICAL RESEARCH GROUP: 1923–26[1]

F. V. SIMONTON, D.D.S., *Chairman*

University of California, Berkeley and San Francisco, California

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I. GENERAL NOTE

To the best of my knowledge, items marked * represent new findings. Those marked † are confirmatory of old findings. Those marked § contradict past findings.

II. BACTERIOLOGY

Ivan C. Hall, Ph.D.

A. "Bacterial factors in pyorrhea alveolaris. I. Microbic changes in saliva." *Journal of the American Medical Association*, November 17, 1923, lxxxi, pp. 1676–1679

* 1. A mass-reaction curve due to the effect of the bacterial activity in the saliva *in vitro*.

* 2. Halituous fetor may but does not necessarily accompany salivary putrefaction.

[1] Submitted for publication, at the invitation of the Editor and in the form suggested by him, on March 11, 1926. Printer's proofs were revised, and the summary brought up to date, by the author on November 12, 1926. See the Addendum.

* 3. Halituous fetor is due to organisms destroyed by boiling, while putrefaction may be due in part to organisms not destroyed by boiling.

* 4. Halituous fetor never occurs while fermentative changes are in progress.

Ivan C. Hall, Ph.D. (with Clayton Westbay, D.D.S.)

B. "Bacterial factors in pyorrhea alveolaris. II. Further studies on reaction changes in saliva due to microörganisms and their possible relation to the formation of dental calculus." *Dental Cosmos*, February, 1925, lxvii, pp. 115–124

* 5. The reaction curve for incubated saliva is characteristic, irrespective of whether the samples are gathered from healthy mouths or mouths in which dental disease is present.

* 6. This reaction curve (5) is uninfluenced by differences in age or nationality.

* 7. Close stoppering of incubated saliva prevents the alkaline change so characteristic of loosely stoppered or open samples, but does not prevent the development of fetor.

† 8. Bacterial changes in stagnant saliva may influence the precipitation of dental calculus. If alkaline changes were responsible for the precipitation of mineral salts in dental calculus, the fact that calculus is produced in the region of the gingival margin rather than in the depth of the pyorrhea pocket might be due to the release of CO_2 at the latter site.

* 9. Mineral salts are more abundant in the fluid portion of fresh saliva than in the cellular part.

* 10. Although no significant variation in totally dissolved mineral salt content could be detected in samples incubated for varying periods of time, either in closely stoppered samples whose reaction remained neutral or in loosely stoppered samples whose reaction became alkaline, yet calcium was strongly precipitated in both cases in about forty-eight hours.

Ivan C. Hall, Ph.D.

C. "Bacterial factors in pyorrhea alveolaris. III. The isolation of *B. tetani*, *B. welchii*, and other sporulating anaerobes from

human saliva." *Journal of Infectious Diseases*, July, 1925, xxxvii, pp. 87–92

* 11. Sporulating anaerobic bacteria are only occasionally demonstrable in the saliva as spores.

* 12. *B. welchii*, *B. tetani*, *B. bifermentans*, and *B. tetanomorphus* have been recovered from saliva.

* 13. These organisms (12) are evidently transient saprophytes in the mouth.

* 14. Aerobic sporulating bacteria are evidently transient saprophytes in the mouth.

* 15. There is no evidence that the sporulating aerobes or anaerobes have any direct pathologic significance in relation to pyorrhea, but certain species may participate in the deposition of salivary calculus.

Ivan C. Hall, Ph.D. (with Beatrice Howitt, B.S.)

D. "Bacterial factors in pyorrhea alveolaris. IV. *Micrococcus gazogenes*, a minute gram-negative non-sporulating anaerobe prevalent in human saliva." *Journal of Infectious Diseases*, August, 1925, xxxvii, pp. 112–125

† 16. There occurs frequently, in human saliva, a minute gram-negative, non-sporulating, gas-forming obligate anaerobe, the *Micrococcus gazogenes* (Lewkowicz). This organism has been overlooked in most of the modern work on the mouth flora.

* 17. The above organism (16) is non-pathogenic directly for rabbits, guinea-pigs, and mice, but appears to reduce the resistance of rabbits toward other pathogenic microbes of which they are carriers, notably *coccidia*.

* 18. Normal rabbits, while they may harbor *M. gazogenes*, produce no agglutinins except under inoculation.

* 19. Human beings not infrequently produce low-grade agglutinating serums against *M. gazogenes*, the strongest serums coming from persons free or practically free from gingival lesions, suggesting an immunologic factor relating to this organism in pyorrhea.

T. D. Beckwith, Ph.D.

E. "The dark-field microscope in pyorrhea and oral infections." *Journal of the American Dental Association*, October, 1925, xii, pp. 1228–1230

† 20. The dark-field microscope is of value in observing the presence of certain organisms in pyorrheal lesions and in examination of cases of Vincent's infection.

† 21. Observations with the dark-field microscope of smears from detritus removed from pyorrheal pockets show the presence of an enormous number of organisms.

* 22. During the course of treatment (by scaling), the spiral forms diminish first, the larger rods follow, and finally the micrococci are decreased.

F. "The presence of bacterial microörganisms within human gingival tissue in gingivitis." *Proceedings of the Society for Experimental Biology and Medicine*, 1925, xxiii, pp. 140–143

† 23. The presence of a variety of bacterial forms, especially streptococci and what appear to be diphtheroids, can be shown within the gingival tissue, and closely adjacent to lymph channels in human gingival tissue removed at biopsy, from subjects showing gingivitis.

† 24. The macrophage may be an important factor in the phagocyting of microörganisms.

* 25. By a certain technique, microörganisms from within the gingival tissue may be cultivated.

* 26. Positive cultures may be obtained from a considerable percentage of aspirations made from the gingival tissues. These cultures have shown *Staphylococcus albus, Staph. aureus, Strep. pyogenes, Strep. equimus, Strep. angiosus, Strep. salivarius, Strep. mitis, Strep. infrequens, Strep. ignavus, Strep. non-haemolyticus, Strep. equi, and Micrococcus gazogenes.*

A. P. Batchelder

G. "A study of the relation of microörganisms to pyorrhea and its treatment" (unpublished manuscript)

† 27. A marked diminution of the bacterial flora, both in morphologic variety and in total numbers, accompanies successful treatment of pyorrhea through scaling and hygienic procedure.

* 28. The spirals, fusiforms, and very small, fine bacilli experienced the greatest reduction.

* 29. The cocci and *B. subtilis* were least reduced.

* 30. Some reduction occurred about the control teeth due, quite possibly, to the inoculating effect of the instrumentation.

Note: The method used by Mr. Batchelder was that of direct smears and percentage counts, together with cultural procedures. Dr. Beckwith's similar findings (22) were made by an entirely different method; namely, by the use of the dark-field microscope. It is of interest, also, that the organisms which respond least to ordinary cultural methods are most affected by treatment, whereas those which respond best to ordinary cultural methods are least affected by treatment.

T. D. Beckwith, Ph.D. (with L. F. Morrison, M.A.)

H. "The occurrence of clasmatocytes in oral conditions related to pyorrhea." *Journal of the American Dental Association,* January, 1926, xiii, pp. 38–45

* 31. The clasmatocyte of Ranvier can be shown to be present in the region of the gingival margin in a large percentage of cases of pyorrhea.

* 32. The presence of this defensive cell in gingival smears is definitely related to the inflammatory factor.

A. P. Batchelder

I. "The recovery of bacteriophage from the saliva. Its relation to oral conditions" (unpublished manuscript)

† 33. One or more protective factors are at work in the oral cavity.

* 34. An active bacteriologic agent, which is transmissible in series and conforms in all other respects to the activities of the agent of the Twort-d'Herelle phenomenon, may be obtained from human saliva.

* 35. The presence of a bacteriolytic agent (bacteriophage), and of bactericidal agents in the saliva, is associated with an absence of marked dental disease. The absence of bacteriophage and of bactericidal agents is associated with the presence of marked dental disease.

III. PROTOZOOLOGY

C. A. Kofoid, Ph.D., Sc.D. (with Olive Swezy, Ph.D.)

J. "The cytology of *Endamoeba gingivalis* (Gros) Brumpt compared with that of *E. dysenteriae*, with special reference to the determination of the amoebas in bone marrow in arthritis deformans of Ely's Second Type." *Journal of the American Dental Association*, February, 1925, xii, pp. 175–196

* 36. *E. gingivalis* is morphologically distinct from *E. dysenteriae.*

* 37. The food vacuoles of *E. gingivalis* contain leucocytes, or their nuclei, and certain bacteria; the latter, however, are a minor element.

B. F. Howitt, B.S.

K. "The cultivation of *Endamoeba gingivalis* (Gros)." *University of California Publications in Zoology*, 1925, xxviii, pp. 65–126

* 38. *E. gingivalis* may be grown in artificial culture, and such a culture prolonged indefinitely.

* 39. The initial pH for optimum growth lies between 7.0 and 7.8.

* 40. *E. gingivalis* can withstand a high percentage of calcium but not of $NaHCO_3$. It is slightly more affected by omissions in the sodium content than by those in the potassium or the calcium content.

* 41. The optimum growth in culture is obtained in glucose concentrations as high as 0.1 per cent. If the concentration is above this, the organisms soon disappear.

* 42. *E. gingivalis* feeds on bacteria in the cultures and shows a strong preference for the ingestion of lipoidal yolk bodies, also both human and animal red blood corpuscles, although there is a greater preference for washed human erythrocytes than for the others.

* 43. *E. gingivalis* is able to exist and multiply in the presence of cod-liver oil and certain proteins, peptones, and amino acids.

*44. A temperature of 37°C. is the most favorable for optimum growth.

L. "The effect of certain drugs and dyes upon the growth of *Endamoeba gingivalis* (Gros) in vitro;" and "Experiments with *Endamoeba gingivalis* (Gros) in mixed bacterial cultures; in filtered saliva; on a solid base; with peritoneal cells; and with digestive secretions." *University of California Publications in Zoology*, 1926, xxviii, pp. 173–182, and pp. 183–202

*45. Of the following substances, stovarsol is the most effective against cultures of *E. gingivalis:* stovarsol, sulfarsphenamine, neoarsphenamine, acid arsphenamine, neutralized arsphenamine, acetylarsan, emetin, yatren, acriflavine, and gentian violet. Yatren is the least effective.

*46. The arsenical compounds are more toxic than the nonarsenicals.

*47. Emetin hydrochloride, although somewhat toxic for amoebae, is nevertheless not specifically effective *in vitro*.

*48. Of the dyes, acriflavine and gentian violet, the former can be used only in high dilutions, because of its toxicity, while the latter may be used in very much stronger concentrations without greatly hindering the amoebic growth.

*49. *E. gingivalis* thrives in the presence of filtered human saliva, provided a solid substrate of coagulated egg is present, and also grows in Locke-albumen medium having a base of coagulated serum or of agar, if the latter has not too slippery a surface.

*50. Both washed red blood corpuscles and leucocytes from the guinea-pig were ingested by *E. gingivalis*. When both types of cells were present, the preference was for erythrocytes.

*51. *In vitro*, *E. gingivalis* is unable to withstand contact with human gastric juice containing the normal amount of acid, but survives for several hours in fluid lacking free HCl, or having a reduced amount of it.

David Causey, Ph.D.

M. "Mitochondria and Golgi bodies in *Endamoeba gingivalis* (Gros) Brumpt." *University of California Publications in Zoology*, 1925, xxviii, pp. 1–18

* 52. Mitochondria, Golgi elements, and fat bodies were demonstrated in *E. gingivalis*.

* 53. Mitochondria take part in cellular metabolism and are intimately associated with both food vacuoles and amoeboid movement.

* 54. They are probably metabolic products playing the part of plasts.

* 55. The Golgi elements are probably derivatives of the region surrounding the food vacuoles and are metabolic in function.

* 56. The amoeba probably has a spiral organization.

IV. HISTO-PATHOLOGY

***T. D. Beckwith, Ph.D.** (with F. V. Simonton, D.D.S., and Adrienne Williams, M.A.)*

N. "A histologic study of the gum in pyorrhea." *Journal of the American Dental Association*, February, 1925, xii, pp. 129–153

† 57. There is no adequate reason to ascribe the cause of pyorrhea to any specific microörganism.

† 58. Infectious organisms probably follow from the gum to the apex of the tooth through the peridental membrane.

† 59. Infectious processes complicate and intensify the pyorrheal condition.

† 60. There is evidence that the portal of entry for organisms is from the depth of the gingival sulcus.

† 61. Infiltration in the submucosa is perivascular, and the inflammatory reaction is subacute.

* 62. The inflammatory reaction follows the direction of the connective tissue bundles.

† 63. Repair is a difficult process accompanied by many interruptions.

† 64. The infectious agents penetrate the lymph channels by their own motility or proliferation, or as a result of lytic action upon the walls of these spaces. * Microbial forms are shown in the lymph sacs.

† 65. The incidence of potentially and actively pathogenic microorganisms in the gingival crevice is such that it is unexpectedly difficult to find normal gum tissue.

† 66. The microörganisms advance by way of lesions of tissue, hemorrhagic areas, and possibly other agencies.

§ 67. No evidence was found of spirillums or spirochetes within the tissues. Rods and cocci were observed, however.

* 68. Growth of leptothrix and mycelium in and within the crevices of degenerating epithelium was shown.

T. D. Beckwith, Ph.D.

O. Studies of repair following experimental injuries to dental tissues in the guinea-pig, rabbit, cat and dog (in progress)

V. NUTRITION

L. L. Stanley, M.D.

P. "Diet of prisoners at San Quentin." *Journal of the American Dental Association*, February, 1925, xii, pp. 161–165

* 69. Observations of the general physical and dental conditions of fifty-seven prisoners, varying in age from 17 to 69 years, for a period of three years, revealed that these men did well on a diet markedly deficient in vitamine content. Vitamine A was supplied probably only in corn products and in a small amount of milk. Vitamines B and C were probably supplied by beans and tomatoes.

Guy W. Clark, Ph.D.

Q. "Acid- and base-forming elements in foods." *Journal of Biological Chemistry*, 1925, lxv, pp. 597–600

* 70. The Ca, Mg, Na, K, Cl, P, S, and N content of a series of foods, and methods of analysis.

Note: Papers on inorganic salt metabolism in man, and inorganic constituents of human saliva, are in press. (See the Addendum, GG.)

C. L. A. Schmidt, Ph.D., and R. N. Loomis, M.A.

R. Study of the isolation of mucin, and its physical and chemical properties (in progress)

Helen Updegraff, Ph.D.

S. "Concerning the presence of sugar in saliva." *Dental Cosmos*, March, 1926, lxviii, pp. 237–239

† 71. The elimination of sugar in the saliva is a rare phenomenon even in cases of severe diabetes; nevertheless it may occur in some advanced cases.

F. V. Simonton, D.D.S.

T. "Progress report of studies of pyorrhea by the California Stomatological Research Group." Presented at the meeting of the American Dental Association, Louisville, September, 1925. *Journal of the American Dental Association*, November, 1926, xiii, pp. 1586–1592

* 72. A pathological condition has been observed in the teeth of dogs on experimental diets, conducted by Martha R. Jones, Ph.D., in which the acid-base balance has been disturbed, but in which all essential factors, including vitamines, are present. This condition is clinically distinct from dental caries. It is characterized by a loss of tooth substance *en masse*, progressing from without inward, advancing through the tooth substance in parallel linear extensions rather than in flame-like extensions. This condition has been designated "*odontoclasia.*"

* 73. Conditions similar to the above, both clinically and microscopically, have been observed in humans.

Martha R. Jones, Ph.D. (with F. V. Simonton, D.D.S.)

U. "Changes in the alveolar process about the teeth in dogs on experimental diets." *Proceedings of the Society for Experimental Biology and Medicine*, 1926, xxiii, pp. 734–739

* 74. Changes occur in the alveolar process of adult dogs on experimental diets in which the acid-base balance is disturbed but in which all essential food factors, including vitamines, are adequate.

* 75. Retrograde changes in the alveolar process are associated with an unbalance in which the base is in excess.

* 76. Reconstructive changes occur when the acid is in excess.

Martha R. Jones, Ph.D.

V. "Studies on inorganic salt metabolism. III. The effect of varying the acid-base balance of diets which are adequate for growth in respect to proteins, fats, carbohydrates, inorganic salts, and vitamins" (in preparation)

* 77. Profound skeletal defects may be produced in young animals on diets whose only known faults are a disproportion in their acid-base balance. Concomitant with skeletal abnormalities, a variety of dental lesions which simulate conditions occurring in man have been observed.

W. "Studies on inorganic salt metabolism. II. The effect of the sudden alteration of the acid-base balance of the diet on dogs." *Proceedings of the Society for Experimental Biology and Medicine*, 1926, xxiii, pp. 578–581

* 78. Convulsions, followed by death, have frequently been observed to occur in experimental animals after sudden alteration of the acid-base balance of the diet.

* 79. These convulsions appear to result from an increase in the acid or alkali content of the diet beyond the limit of tolerance of the animal, as well as after the sudden reversal of the dietary reaction.

*80. The nutritive condition of these animals has been excellent, there having been no known dietary fault other than a disproportion of its acid-base balance.

* 81. Post-mortem examinations showed marked injection of all of the organs; also enlargement of the heart; brain and cord hemorrhages; terminal pneumonia; and failure of blood to coagulate after standing several hours.

* 82. The rate of diffusion of ions through membranes, as influenced by the concentration as well as proportions of body fluids, may have a direct bearing on such conditions as rickets, tetany, hemophilia, allergy, spasmophilia, faulty kidney function, and other obscure disorders.

Note: By Martha R. Jones, Ph.D. Further experiments on inorganic salt metabolism in dogs, involving certain disproportions in acid-base balance, and resulting in significant skeletal and dental defects, are in progress—also an application of hypotheses derived from these studies to diet experiments with humans.

VI. DENTAL STUDIES

L. L. Stanley, M.D., and F. V. Simonton, D.D.S.

X. "A comparative dental study of Mexicans and whites" (in press)

* 83. The third molars are slower to erupt in Mexicans than in whites.

* 84. The teeth of Mexicans of all ages between 18 and 68 years of age are decidedly better, as regards caries and loss, than are those of the whites.

* 85. The pyorrhea curves show decided drops at the ages of twenty-two and thirty-two. In the Mexicans the curve drops off again between the thirty-third and fifty-third years; in the whites, from the forty-eighth year on.

Willard C. Fleming, D.D.S.

Y. "Localization of pyorrheal involvements." *Dental Cosmos*, June, 1926, lxviii, pp. 538–541

* 86. The incisors and molars are most involved.

† 87. The interproximal destruction occurs earliest.

* 88. Localizations are bilaterally symmetrical.

F. V. Simonton, D.D.S.

Z. †(a) "Examination of the mouth, with special reference to pyorrhea." *Journal of the American Dental Association*, March, 1925,

xii, pp. 287–295; †(b) "Technic involved in measuring destructive changes of investing tissues of the teeth." *Ibid.*, April, 1925, xii, pp. 448–453; †(c) "A conservative method for the treatment of pyorrhea." *Ibid.*, February, 1925, xii, pp. 197–202; *(d) "Roentgenographic standardization" (unpublished manuscript)

† 89. Methods for determining with precision the incidence and extent of pyorrheal lesions.

AA. "Definition and classification of pyorrhea." *Dental Cosmos*, February, 1926, lxviii, pp. 158–12

† 90. A method of defining and classifying pyorrhea.

G. W. Simonton, D.D.S.

BB. "The treatment of pyorrhea by surgical exposure of the tissues involved." *Journal of the American Dental Association*, March, 1925, xii, pp. 329–332

† 91. An application of the surgical exposure method to the treatment of pyorrhea.

W. H. Hanford, D.D.S., C. O. Patten, D.D.S., Clayton Westbay, D.D.S., and F. V. Simonton, D.D.S.

CC. "The effect of instrumental treatment upon the tissues in pyorrhea. A study in histo-pathology." *Dental Cosmos*, January, 1923, lxv, pp. 12–17

* 92. Instrumental treatment alters the processes in a pyorrheal condition. Tissues previously in a rapidly degenerating state exhibit reconstructive activities.

Note: Clinical studies are in progress in which observations are being made of the effect upon pyorrhea of instrumentation alone, and together with such auxiliaries as quartz-ray, roentgen-ray, diet, etc.

VII. MEDICAL STUDIES

F. P. Wisner, M.D., M.A., and Clayton Westbay, D.D.S.

DD. "Study of systemic and dental conditions of fourteen dental students." *California and Western Medicine*, August, 1925, xxiii, pp. 980–981

* 93. The student in the poorest physical condition had the best teeth.

* 94. The only tendency of pyorrhea to group with systemic findings was a connection with abnormal conditions of epithelial structures, as baldness, sensitive skin, acne, etc.

F. P. Wisner, M.D., M.A.

EE. "Focal infection: A medico-dental problem." *California and Western Medicine*, August, 1925, xxiii, pp. 977–980

† 95. Oral focal infection is an inseparable part of general focal infection.

† 96. The commonest primary lesions occur in teeth, tonsils, sinuses, and prostate.

† 97. Secondary foci may exist almost anywhere throughout the body.

† 98. The primary lesions are usually symptomless, and need not yield pus, rendering them difficult to locate.

† 99. The remote effects are due to bacteria or their toxic products transported by way of the blood or lymph stream.

† 100. Streptococci are the commonest organisms concerned in focal infection, although others may be responsible.

† 101. Among the dental pathological conditions responsible for focal infections, periapical infection and pulpless teeth are of prime importance. Pyorrhea must also be considered.

* 102. Local surgical treatment often requires to be supplemented by general measures designed to build up bodily resistance against inaccessible foci.

VIII. EVOLUTION

F. V. Simonton, D.D.S.

FF. "Is evolution a factor in parodontoclasia?" *Dental Cosmos*, June, 1926, lxviii, pp. 542–543

* 103. Evolution is probably not a factor in parodontoclasia.

IX. GENERAL DEDUCTIONS

F. V. Simonton, D.D.S.

It is the writer's opinion that the practice of periodontia in the future will be concerned with the diet of the patient in terms not only of the elements but of their proportions, and with their assimilation and utilization; with the blood, saliva, and urine findings; with the general health conditions; with the function of the teeth, and with rational therapeutic measures planned in accordance with the bacterial conditions as they prevail in the individual mouths. Application will be made of the developments of research on local immunity. Endocrine factors will be taken into consideration. In addition, such local treatment as is at present in vogue will continue to be essential. A much more minute utilization of the revelation of the roentgenograph will be made.

ADDENDUM

X. NUTRITION: SUPPLEMENTARY TO V, ITEMS 69–82

Guy W. Clark, Ph. D.

GG. "Studies in the mineral metabolism of adult man." *University of California Publications in Physiology*, June 19, 1926, v, pp. 195–287

*104. The excretion of potassium by way of the colon is three to seven times that of sodium. The average excretion of potassium varied from 16 to 29 per cent, that of sodium from 2.7 to 9.9 per cent.

*105. On different diets, in which the excess of acid- or base-forming elements varied from 3.5 cc. to 230 cc. of normal acid to 33.7 to

480 cc. of normal base per week, all subjects showed marked base retention (from 64 to 226 cc. of 0.1 N solution per day).

*106. The addition of eggs (one per day) and carefully cooked vegetables (17th to 28th weeks) increased the retention of calcium and phosphorus. At the same time there was a marked retention of nitrogen and sulfur, and also considerable increase in body weight.

*107. The prolonged storage of calcium and phosphorus, and the general retention of base, indicate that the general prison diet (the experiments were carried on with inmates of San Quentin Prison) does not contain all of the necessary foods (or at least is not in adequate amounts). The most apparent deficiency is that of vitamines.

*108. The results of blood analyses fail to show any significant changes. All data reported lie in the lower limits of normal values.

XI. DENTAL STUDIES: SUPPLEMENTARY TO VI, ITEMS 83–92

Willard C. Fleming, D.D.S.

HH. "Localization of pyorrheal involvements." *Dental Cosmos*, June, 1926, lxviii, pp. 538–541

*109. The occurrence of such localization as has been shown suggests the influence of local factors. There are, however, many mouths where local factors exist, capable of initiating the perpetuating lesions in suceptible cases, which nevertheless remain healthy.

*110. The bilateral symmetry of all graphs is very suggestive of a systemic substrate, upon which is superimposed the effect of local factors.

*111. Where susceptibility is present, the curve of localization will be traced in part by the mechanical and chemical irritants; in part by bacterial activity, and in part by anatomical and histologic variations in the structures.

*112. Abnormal occlusal stresses are not sufficient in themselves to account for the localizations which occur. This factor has been overemphasized as an etiologic agency. Can "traumatic occlusion" explain why 37 per cent more detachment is found on the interproximal surfaces of incipient cases than on the combined facial and lingual surfaces? Can "traumatic occlusion" explain why there is

more detachment on the upper posterior teeth than on the upper incisors and more detachment on the lower incisors than on the lower molars? Can it explain why there is nearly twice as much detachment on the mesial surfaces of the third molars as on the distal surfaces? Can it explain why the cuspids, which are consistently exposed to "traumatic occlusion" in most mouths, can just as consistently show less detachment than any of the other teeth?

*113. These observations on localization show definitely that local factors must be given adequate consideration.

*114. As the disease progresses, the degrees of involvement along the several surfaces of the teeth tend to equalize. This equalization may be due in part to mobility of the teeth at this stage.

SOME THOUGHTS CONCERNING PULPLESS TEETH[1]

HAROLD S. VAUGHAN, M.D., D.D.S., F.A.C.S.
New York City

There is no subject in the whole domain of pathology more hackneyed than the pulpless tooth problem. The practitioner eager to absorb all of the literature on the subject is likely to become completely confused, for the published papers represent the most widely divergent extremes of opinion and prejudice; and, unless he cultivates a careful discrimination and sound sense of proportion, he is likely to be alternately stampeded from one extreme of practice to another.

We are usually unable to make a positive statement that can be verified by laboratory tests as to the part played by a suspected tooth in a given systemic ailment. We must base our opinion largely on clinical study and experience. A patient comes to us suffering from a systemic disease. It may be rheumatism, arthritis, neuritis, toxic headache, impaired hearing, or inflammatory diseases of the eyes, as iritis, iridic-cyclitis, thrombosis of retinal vessels, etc. Certain teeth are pulpless and, by radiograph, show distinct evidence of apical disease. We cannot state positively that these teeth are the causes of this systemic involvement, but we have a sufficient background of clinical experience to know that these teeth are infected and, in that condition, should not be allowed to remain in the patient's mouth.

Even at this late date, there are dentists who ignore the presence of discharging sinuses, with the defense that they are harmless so long as there is an outlet. These dentists also retain teeth that show large periapical areas of bone destruction, and do so with the naïve statement that it is scar tissue or due to trauma, especially when they themselves are responsible for the root-canal filling. On the other hand, there is a very large group who preach that every tooth that has lost its pulp should be removed, irrespective of clinical condition

[1] Read at a meeting of the New York Academy of Dentistry, February 19, 1924.

or radiographic finding. Some who make up this group are, I suspect, more ready to follow the easy road than the more difficult one of painstaking root-canal technique.

You will bear with me if I take up your time in going over certain elementary details in dental histology that bear on the pulpless tooth, to refresh our minds as to the way infection occurs in a tooth that has lost its pulp. The dentin makes up the mass of the tooth, the structural elements of which are the dentin matrix, the sheaths of Newman, and the dentinal tubules. The contents of the dentinal tubules—the dentinal fibrils—are protoplasmic filaments that pass out from the pulp. The outer layer of dentin next to the cementum is known as the granular layer of Tomes, and is caused by irregular spaces in the dentin matrix, which connect with the dentinal tubules. Some writers have claimed that these spaces of the granular layer communicate with the cementum as well as with the dentin, although Noyes and others have not been able to confirm this view, but consider the granular layer to be separated from the cementum by a thin layer of structureless dentin. The first layer of the cementum does not contain canaliculi or lacunae. Other experiments with extracted teeth have demonstrated that drugs do not diffuse into the dentin unless the cementum is removed, which shows that the cementum is not readily invaded by bacteria from the pulp canal, except through the foramen or accessory foramina. This is proven by the occasional occurrence of a granuloma or abscess on the middle of the root by extension through one of these foramina.

The structural elements of the dental pulp are connective-tissue cells, intercellular substance, blood vessels, nerves, lymphatics, and odontoblasts. The pulp nourishes the dentin through protoplasmic filaments from the odontoblastic layer. After death of the pulp, the dentin is left without nourishment and is dead, but the cementum and pericementum are nourished, if they have not been damaged or destroyed by subsequent infection through the foramina. Therefore, contrary to the opinion expressed by those who advise removal of all pulpless teeth, these teeth are not dead.

The cementum is a connective tissue the intercellular substance of which is calcified and arranged in lamellae or layers around the circumference of the root. It is closely related to subperiosteal bone in

structure, except that the arrangement of the lacunae and canaliculi is less regular than in bone, and Haversian canals are not present. It is the function of the cementum to give attachment to the connective-tissue fibres that hold the teeth in position, and to seal-in the tubular contents of the dentin. The only vulnerable points are the nutrient foramina to the pulp.

The pericementum or peridental membrane surrounds the root and serves to attach the tooth to the alveolus. Its integrity at the root apex is of the greatest importance because, once it has been denuded or lifted away from the apex of a root by an infective inflammatory or suppurative process, the adjacent lacunal corpuscles of the cementum lose their vitality and become invaded by bacteria. The indications are to sterilize and fill the pulp canals before infection destroys the apical portion of the cementum, pericementum, and adjacent periapical tissue.

Let us review what occurs when a pulp dies and bacteria pass through the apical foramen or foramina. The reaction depends upon the varieties and virulence of the infecting organisms. There is a local stasis of circulation, migration of leucocytes, and exudation of plasma into the tissues. This process may progress to a liquefaction of tissue elements, with the formation of an acute abscess and the discharge of its contents; or, it may be extremely limited, so that the pericementum is separated from the cementum over only a minute area immediately in contact with the foramen or foramina; or, it may involve a considerable portion of the apical end of the root before the infective process becomes walled in. In any case, whenever the apical pericementum is lifted up, and its attachment is destroyed by bacterial action, the corpuscles in the lacunae of the cementum die, and these lacunae and their canaliculi are permanently invaded by bacteria. I do not believe we have any method of sterilizing them by root canal therapy.

In the periapical rarefied areas the reaction difference is one of degree only. The process is essentially the same, depending on the variety and virulence of the infecting organism. In nearly all such teeth that I have examined, the pericementum has been separated from the cementum. There may be a thickened apical pericementum with a smooth moist lining over the inner surface in relation to the

denuded apex. There may be a considerable production of plasma cells and the formation of new connective tissue, infiltrated with numerous leucocytes and round cells—a granuloma—though the surface in contact with the root apex is usually smooth and moist due to breaking down and liquefaction of some of the tissue elements. The rarefied area may consist of a dense, thick, walled sac, often called a pyogenic membrane, the contents being serous pus or sometimes thick inspissated pus. The sac may be much thinner than the former and filled with a straw-colored fluid of the consistence of glycerine, in which are numerous cholesterol crystals, and is then known as a radicular cyst.

The process is essentially the same in all, except that the cyst-lining, regarded by most pathologists as epithelial, possesses a greater secretory function, and is thought to be derived from retained embryonic enamel-organ cells. The cyst content is frequently sterile, although I have always had positive cultures from the apical ends of such teeth. The external covering of a granuloma, abscess, or cyst is always continuous with the pericementum. This arrangement is nature's attempt to wall off the infected area and limit the extension of infection into the system. Nature does not, however, entirely succeed in preventing this extension. Mendel, of the Pasteur Institute in Paris, has shown me specimens where he inoculated the pulp chambers of rabbits with tubercle bacilli. This was followed by small rarefied areas around the apices, but the active tubercular lesions were always found in the cervical lymph nodes, thus disproving statements sometimes heard that these areas are walled from the general circulation.

I will not attempt to formulate any fixed rule for the retention or removal of pulpless teeth, but will give certain conclusions obtained from clinical examination, the study of radiographs, the examination of apices and apical tissues after removal, and bacterial findings.

X-ray interpretation does not constitute the complete diagnosis we are often led to believe. It is an aid that must be correlated with a clinical examination of the teeth and adjacent structures. Transillumination is often of value, especially in showing a root that is black and opaque as a result of decomposition of the tubular contents. The study of a good radiograph of the teeth and surroundings enables one to visualise the condition of these structures, if our impressions

are based upon a clinical and post-operative study of a sufficient number of cases. Certain radiographers, with little or no clinical experience, readily differentiate these rarefied areas. One will be a granuloma, another an abscess, another a cyst, but the experienced clinician is never quite so sure. They may be areas of cancellous bone in operated areas. Inner or outer plates may be missing.

The removal or retention of pulpless teeth depends upon the clinical history and appearance of the tooth and adjacent tissues, and upon the condition of these tissues, as shown by the radiograph and by the history and general physical conditions of the patient. We see cases of mouths in shocking condition, with infected teeth in all stages of activity. Many of these people seem to show no general ill effects. This is explained by the greater resistance of the individual or lessened virulence of the infecting organism. However, it does not mean permanent security, for an increase in virulence of the organisms or lowered vitality of the patient may permit a general lighting up of the infection. Pneumonia, when it develops following exposure to cold, is not due to a new infection, but results from increased activity of organisms already present, and from the added factor of lowered vitality. Therefore, I see no basis for argument in favor of allowing known infection to remain because there is no definite proof of present activity.

Pulpless teeth that by careful radiographic study show no destruction of apical tissues can, after thorough sterilization and canal filling, remain without danger of later infection. We know that, with the apical pericementum intact, new cementum may be deposited over the apical foramina. After thorough sterilization and filling, many teeth with the granuloma type of infection apparently clear up, that is, the apical infection is reduced to such an extent that bone regeneration occurs up to fairly close contact. A percentage of such teeth may be regarded as free from apical infection; but, if the apical pericementum has once become detached by bacterial action, the lacunae harbor bacteria that are out of reach of any root-canal therapy. I consider root resection necessary in such cases, when it is desirable to retain such a tooth.

I feel that the vast majority of teeth that on radiographic examination, reveal a destruction of apical tissue should be removed, followed

by a careful elimination of the infected tissue, with a curette of a size and shape that permits one to reach every surface of this area. Certain pulpless teeth that have a walled sac and liquid content, whether purulent or cystic, can be retained if the entire denuded apical portion is removed after complete sterilization and filling; provided that such teeth are not darkened and opaque throughout the entire dentin from prolonged decomposition, and are suitable for resection as determined by location and by the condition of the surrounding tissues and the cervical pericementum.

We will pass over the methods of root-canal sterilization except to say that the aim should be to permeate the tubules with antiseptics and then to seal them, preferably with gutta-percha compounds.

Much has been written about sclerotic changes that occur in bone as a result of infection around pulpless teeth. I have made a careful study of hundreds of radiographs, and find that the occurrence of these areas of dense bone is quite infrequent and entirely without relation to pulpless teeth. The regenerated bone following a cleaning up of root-end infections is usually somewhat less dense than normal, though in certain areas it may be densely calcified. Some operators advocate turning down a large gum flap followed by a cutting away of all of the adjacent bone, claiming that such bone is diseased. Such crude methods cannot be too strongly condemned. I believe all sharp edges and margins of bony processes should be carefully planed off, but with proper instruments all diseased tissues can be cleared out without such wholesale destruction. I am a strong believer, however, in the practice of surgically removing all diseased tissue, rather than having it carried off through the circulatory channels.

To summarize: For pulpless teeth in general, I look upon root-canal treatment and filling as preventive rather than curative. I would classify them conveniently as follows:

(1) Pulpless teeth where an unbroken pericementum can be followed over the apex; can usually be root filled; and will remain safe, if the canals are accessible.

(2) Pulpless teeth with a proliferative apical pericementitis (granuloma) may resolve, and again become healthy, following root-canal therapy, if the apical pericementum has not been detached. These

cases, however, should be looked upon as doubtful for root therapy, unless followed by apical resection.

(3) Pulpless teeth with separation of the pericementum from the cementum over a greater or less portion of the apex. In this class are the open discharging abscesses, some granulomas, the closed abscess, and the cyst. Such teeth should be retained only after root resection and then only after a very careful study to determine the condition of the gingival pericementum and surrounding structures, the condition of the dentin, occlusion, etc.

The teeth which can be resected are the six anterior, both maxillary and mandibular. The bicuspids, maxillary and mandibular, are less favorable. The molars generally are unfavorable.

I will not burden you with histories or statistics of cases relieved of systemic symptoms after the removal of infected foci around pulpless teeth, but will refer to a very recent case history:

Mr. C., age 55; always in good health, except impaired hearing in the right ear. He consulted his oculist for impaired vision in left eye. Certain changes were noted in the retinal vessels, and he was told he had nephritis. The kidneys were found to be normal. Later: diagnosed by other oculists as a thrombosis in the retinal vessels of infectious origin. A complete survey by an internist, to determine sources of infection, showed slight tonsil involvement. Four infected teeth were found after many conflicting opinions had been expressed. These teeth were removed and each was cultured. Staphylococcus aureus was found in all of the cultures. Improvement was marked soon after the teeth were removed, and the eye condition has since completely cleared up.

DISCUSSION

Bissell B. Palmer, Jr., D.D.S. (*New York City*): I think it is true, as Dr. Vaughan has stated, that we have not had a real thorough research in this subject. There has been a little bit done here and a bit there, but not a real strong drive to get to the bottom of this question. If it were simply a question of filling pulpless teeth and retaining them, and getting regeneration of bone, it would not be a very great problem—it would be a matter of technic, and that would be as far as our responsibility would go. The real problem, however, is developed from the fact that these pulpless teeth are

so often involved in systemic infections. When we are confronted with the problem of whether a tooth is possibly or probably causing infection in some other part of the body, what are we going to do about it in the face of inconclusive x-ray evidence and an absence of local clinical evidence.

I think there is no pulpless tooth, regardless of its x-ray appearance, which can be considered a "safe" tooth so far as systemic infection is concerned. I agree that there are pulpless teeth, as Dr. Vaughan has said, having an undamaged peridental membrane at the apex, which may be considered safer than others. But to say to a medical man who wants the absolute truth: "this patient, dentally, has a clean bill of health," when there are pulpless teeth in the mouth, is to my mind giving a questionable piece of advice. The teeth *may* not be involved and *may* not be causing the focal infection, but to say positively that they are not causing it, I do not think is good judgment. I think every pulpless tooth is a potential trouble maker, and should always be regarded with a suspicious eye. On the other hand, the pictures of bone regeneration shown by Dr. Vaughan are very interesting, although to my mind not conclusive.

I think the most spectacular case of bone regeneration I have seen was referred to me by a dentist who, in an orthodontic operation, had moved too rapidly the two upper incisors, devitalizing both of them. The patient was a girl of 13 or 14, and the two teeth were just dangling. The girl had gone away for the summer, and this catastrophe had occurred. The dentist was in a very nervous state—a perfect wreck. The father of the girl said: "Is there not something which may be done to retain these teeth?" I said I would do what I could to retain them but that I was not optimistic. The first thing I did was to put on a splint. I then went up over the apices of those teeth and cleaned out a lot of broken-down tissue. The wound healed without event and when x-rays were taken, fourteen or fifteen months later, they showed a decided and almost complete regeneration, such as we have seen in these pictures. Whether that is healthy bone, or whether we could go in there and remove bacteriological growths, I cannot say. We cannot take the stand that because an old area fills in with bone we may regard it as safe.

In handling a case of systemic infection with a suspicious dental focus, I think we should first remove the obviously infected teeth, and then, if there are other pulpless teeth which show no signs of infection and there is a necessity for conservative treatment, send him back to the physician and say: "There is no question about the obviously infected teeth; they should be removed. I cannot see any signs of positive infection about the remaining teeth; they *may* be infected, however. Is there anything else in the

body contributing to his condition? Are there infected tonsils? If so, take them out. When you have taken out every obvious infection, if you still have the secondary infection, then we will be justified in being more radical with these other pulpless teeth." I would say take out a tooth which is of lesser importance, if there be such a thing, and upon removing that tooth, culture it. If, in spite of the fact that there is no break down of cells shown in the x-ray, there is a positive growth, it is a pretty safe assurance that other pulpless teeth in the mouth having the same appearance and filled by the same operator are probably also infected.

The question of the advisability of doing root-canal work for patients suffering from systemic involvement must be considered. Sometimes the patient cannot go through the strain of this work. In advising patients about root-canal work or apex resection, that is a point which must be taken into consideration.

Dr. Vaughan spoke of cases in which he is called upon to operate when an x-ray shows a rarefied area and yet no pathology is present. I also have come across some of those cases. I remember one case in which the patient had already been operated on; a cyst had been removed, and the entire buccal plate removed. It showed up later as a thinned-out area and the physician in the case wanted "the cyst removed." That is in keeping with some of the cases Dr. Vaughan has examined.

Root amputation is being overdone, although in saying this I do not refer to Dr. Vaughan's position at all. Some years ago Dr. Grieves, of Baltimore, brought out some research showing the infiltration of infection right through the dentine, and in such cases it is perfectly absurd to cut off one part of a root and leave a surface just as necrosed at the "new" apex of the tooth.

I also have seen some spectacular results in focal infection cases. The most spectacular have been the eye cases, in which the patient had been treated for weeks by an ophthalmologist who, as a last resort, looked at the teeth and sent the patient to have a tooth or an apex removed. Sometimes in two or three days following such a removal the eye commences to clear up and becomes almost normal. I have seen that half a dozen times. I would like to ask Dr. Vaughan if he has had that same experience.

My average of success in apex amputations has been fairly high, but that is because my cases are carefully selected. If I operated as many cases as I am asked to, my percentage would be considerably lower. I cannot bring myself to the conservative viewpoint of Dr. Vaughan in cases where there is such extensive destruction of bone tissue. In such cases I favor removal of the tooth rather than the apex. I compliment him on the case results he has shown in the slides.

Regarding patients who pick up pneumonia due to lowered resistance, I am reminded of an old expression of the patient who caught cold and "it settled in the tooth." It is a beautiful example of what Dr. Vaughan said: the person has become chilled, and an old area of infection has lit up as a result of that lowered resistance.

Several years ago I made cultures from a series of these so-called border line pulpless teeth, which, in the x-ray, showed no evidence of infection, but which physicians were anxious to have removed because of lesions in other parts of the body. Selecting my cases, principally upper teeth because I found it extremely difficult, except in simple extractions, to take pure cultures from lower teeth even with the best technic I could devise, I made a series of experiments with over 100 teeth. A very high percentage of the cultures showed growths. During the war, when I was over on the other side, those records were lost, but I am going to try it again, for I believe it to be an important investigation.

The buccal-flap operation, which is done throughout the middle West and West for the removal of everything from a loose central to impactions, I believe to be unjustifiable and I am sure Dr. Vaughan does too. There are cases where you must resort to it. I think, however, it is an unnecessary procedure, and an uncalled for destruction of tissue to make a buccal flap in as many instances as some operators are advocating.

The filling of canals to the apex, and the reading of x-rays with that intention, is to my mind unimportant, except as it indicates that a careful operator has done the work; for, if the root-canal filling reaches the apex, probably the medicaments and sterilization have reached the apex. But I do not think it is proper to condemn a tooth merely because the filling does not reach the apex, or to say that the tooth is safe because it does.

L. J. Porter, D.D.S. (*New York City*): I would like to explain one orthodontic case which Dr. Palmer spoke of. This child was cared for by a dentist for about two years. The appliances he used had been procured from some mechanical laboratory. Because he did not understand the use of these appliances, nor know the direction of the pressure applied, a decidedly wrong movement resulted. The lingual springs on the upper appliance, which was rigidly attached to the bicuspid and molar teeth, had depressed the anterior teeth one quarter of an inch by actual measurement. After two years of such treatment the parents became alarmed and the dentist brought the patient to me to "finish" the work, saying that his practice was so large he could no longer care for orthodontia patients. X-ray examination showed that the depressed teeth had been devitalized and were abscessed.

Leland Barrett, D.D.S. (*New York City*): I have some very positive ideas on this subject, and believe pulpless teeth are dangerous to the health of our patients. I myself am an example, with a long standing case of asthma following supposed tuberculosis. I was rejected about ten years ago for insurance. About four years ago I made application for further life insurance, and was fully accepted by two other companies, with no qualifications at all; and the only known reason for the change was the removal of two pulpless teeth. Whether or not these caused any direct condition, I do not know. One was removed by Dr. Hasbrouck, and from its condition and its odor was pronounced badly infected. It did not show any evidence of this in the x-ray. I think you will grant that a young man who, at seventeen, was told he had tuberculosis, and lost a whole year at school and was ordered South—but did not go—has reason to be glad that he is still here on the job. My only explanation is that I lived a rational hygienic life, which increased my vital resistance to the point where the so-called tuberculosis, which evidently it was not, became an acute asthma. I was sensitized to certain things, particularly cheese. If I took a Welsh rarebit at night, I would have an acute attack of asthma. There is no cause known to me for my immediate cure from asthma and the condition I was in, except the removal of those two teeth.

I do not think we can give a *permanent* sterilization to a tooth, and that is the big hitch. I think dentists can sterilize the teeth for a certain period, during which time they are safe, but that after sterilization ceases—the patient becomes susceptible.

I believe that 80 per cent or even 90 per cent of dead teeth are the result of carelessness in not taking care of cavities in time. I am always disappointed, in such discussions, when nothing is said about prevention against "dead" teeth.

It seems to me an editorial in *Dental Cosmos*, for July, 1923, illustrates the situation nicely. I will read you two paragraphs:

"As an illustration of the anomalous, not to say uncertain, position in which we find dental practice today we need only refer the reader to the discussion of a paper by Dr. H. B. Johnston, published in this issue, in which three discussers present three distinctly different views with regard to the performance of a single operation and all at variance with that proposed by Dr. Johnston in his original presentation published in our June issue. Not only do these four acknowledged skilful operators disagree in the important steps of the operation, but the inference is that failure will follow in the wake of either or all of the other three procedures.

"It is true that each of these discussers believes in a very definite and exact technique in performing the root-canal operation, but the inference is quite clear that it must be his own individual technique."

I also want to read portions of a letter I wrote to the Chairman of the Pathodontia Section of the First District Dental Society, in January, 1922, which epitomizes my personal feelings in this important subject:

"As to any evidence I could offer, it is only clinical; but the end results of many dental focal infections removed by extraction, *principally* of course, in cases of constitutional disease, where other possible or probable sources of infection had been eliminated by competent diagnosis, have been so largely successful, with so few failures to secure the expected improvement or cure, that I feel that the most important problem before the dental profession today, is the *prevention* of any pulpless or "dead" teeth whatever. Personally, I have *no* pulpless teeth nor has any member of my family; nor would I have any under any circumstances, for my own experience with two "dead" teeth in past years has been altogether too convincing for me to permit such.

"But in the case of young people of high vital resistance and positively known to be otherwise entirely healthy, the treatment of freshly devitalized and uninfected teeth may be undertaken by conscientious operators of proper skill and training, with some hope of success for a period, *duration unknown*.

"I feel that no truly *scientific* proof of the *complete* and *permanent* sterilization of the so-called "dead" tooth has yet been offered, for the x-ray alone is certainly not to be depended upon, in checking up the future condition of such treated teeth. It is fairly certain, as per reports from the Mayos and others of equally high calibre, that dental infections can and do exist without showing a trace in the x-ray, and I feel it is equally possible that *re*-infections about well-treated teeth may and do subsequently occur without any evidence detectable in the later x-rays so implicitly relied upon as proof of cure."

Andrew Asch, D.D.S. (*New York City*): I would not have gotten up to speak if the President had not asked me to, because I think in a meeting of this kind, where a man presents a paper so well prepared, we should take it home and digest it, and I do not feel we should discuss it off-hand.

Dr. Eby has asked the question: "Just what does ionization do?" I said many years ago that it so alters pathological periapical tissue as to make it easily assailable by the physiological defensive forces of the body. I do not think we get the same condition Dr. Vaughan does with his apicoectomy. If I showed the pictures in my collection of disease and so-called cures, he would advocate keeping the teeth in place with no surgical interference after looking at the pictures of cures.

I think our method of diagnosis is largely at fault. The radiograph means less than we think it does. I do not mean that we should abandon it, but I think it is of less importance than we attach to it. I am sure Dr. Vaughan would not condemn the teeth I call cures, whereas he would condemn them if he saw the original pictures revealing pathology, which shows the fallacy in our method of x-ray diagnosis.

With regard to the flare-up in the child who had the injury mentioned by

Dr. Vaughan: I never resort to ionization (although I do not call it ionization any more, but electrolytic medication) in a freshly extirpated pulp, because electrolytic medication is meant to alter pathological tissue to make it easily assailable by the physiological defensive forces of the body. I think you do get this flare-up from the frightful stimulation and inflammation caused by electrolytic medication in healthy tissue.

R. W. Waddell, D.D.S. (*New York City*): Dr. Vaughan, of course, insists upon sterile root canals and aseptic root filling prior to root resection. In cases where I have considered root resection indicated, I have been unable to dry and fill the canals at this stage owing to constant seepage, and have advocated the practice of filling the root at the time the apex is exposed in the operation of resection.

Dr. Eby spoke of ionization as practised by Dr. Hinman. I have no doubt that those who heard Dr. Johnson's paper before the First District Society will remember that he showed many radiographs of cases in which he had obtained practically the same results with ionization as those of Dr. Vaughan from root resection. His reports from the pathologist and his complete tabulation of so many cases are very convincing; and, following the technique he outlined, my own experience has been very satisfactory.

I do not believe that all pulpless teeth should be condemned but that the condemnation should lie in the direction of the remarkably careless procedure of many who attempt pulp extirpation. About the most dangerous operation in dentistry is that of "capping" exposed pulps. The radical reaction against pulp extirpation has resulted in unwarranted attempts to cover infected pulps with all sorts of antiseptics, culminating in pulp gangrene and dento-alveolar abscess with all of their dangerous sequelae.

Until we obtain much more enlightened methods of prevention, millions of dental pulps will suffer exposure from caries. Let us pray that our skill shall not be so limited that the best we may do is to extract all of these teeth.

President H. W. Gillett, D.M.D. (*New York City*): What I am about to say may sound harsh, but I say it—with a smile. Most of you know my position on the so-called 100 per cent vitality movement. I have held it to be both cowardly and criminal; and have felt that its extreme advocates lacked the courage to tackle the problems brought to them, and that their extreme practice in the removal of functioning pulpless teeth, merely because they might give trouble in the future, seemed to me to be a shirking of professional duty. To insist on removal of teeth presenting no evidence

of local disturbance, for patients with negative history as regards systemic disease, appears to me to run parallel with advocacy of amputation for every leg with a compound fracture for fear of some future complication from its possible unsatisfactory recovery.

There are many practically sound, effectually functioning, pulpless teeth in the mouths of our patients, who we know would suffer serious disability if those teeth were removed. If physical disability exists possibly referable to teeth, or if there are hazards equivalent to those of war service or of prolonged absence out of reach of professional care, I recognize a need for more radical decisions; but I can not recognize, as good professional service, the immediate establishment of one physical disability solely because of fear that another one *may* result later because of conservative action.

I want to ask Dr. Vaughan's comment concerning a procedure which, he will remember, I practised a number of years before I retired: one that I suppose originated with Dr. John E. Nyman. In that type of case of which Dr. Waddell has spoken, where there is difficulty in obtaining requisite dryness to warrant the filling of the root and in which I expected to have an apicoectomy performed, it became my custom first to establish comfortable apical conditions and then to seal the end of the canal with gutta percha, taking precaution to keep gutta percha out of, or to remove it from, that part of the canal in the portion of the root to be retained root-wise. This plugging of the apex prevents further seepage into the canal, and measures calculated to establish sterility of all of the root and canal that is to be kept may then follow. This having been done the section of the canal next the gutta percha apical plug was enlarged, if necessary, and filled with copper amalgam, taking pains to extend it far enough toward the pulp chamber so that the cut for excising the root-end would leave a plug of it in the canal of the retained part of the tooth, provided that there was no inflammatory reaction. This procedure eliminates trouble from seepage, permits of thoroughgoing efforts to establish asepsis in that part of the tooth which is to be kept, provides a canal plug that the surgeon will not injure and one seemingly acceptable to the tissue. It permits, also, the completion of all mechanical work in advance of the surgery, and favors prompt and uninterrupted recovery of the tissues ruptured in apicoectomy.

I then completed the mechanical work, mounted my crown and sent the case to the oral surgeon having consulted him in advance so there should be no misunderstanding. My experience with this technique was satisfactory. I would like Dr. Vaughan's comment as to the use of copper amalgam in this way where he is going to perform a root resection.

Dr. Vaughan (*in conclusion*): I realize there is a tremendous amount of research to be done before we reach a definite basis as to the part played by a given pulpless tooth or teeth in a systemic infection.

Dr. Palmer raised the question regarding the non-infective character of bone that fills-in around a root apex following root canal therapy and apical resection. I feel that bone regenerated in an "area," after a thorough clearing out of the "area," can be regarded as healthy. This is proven in cases of osteomyelitis, where large "areas" or an entire mandible may be replaced by healthy bone after the sections of dead bone have exfoliated.

Dr. Palmer: I referred more particularly to the regeneration of the apex.

Dr. Vaughan (*continuing*): I have removed teeth that have been resected successfully, in cases where the mouth was being cleared of a few remaining teeth. On examination of the new bone it appeared entirely normal. It is only reasonable, in the absence of truth to the contrary, to consider it healthy bone.

Do not be carried away by the enthusiasm of a man here or there who insists that all pulpless teeth must be removed but wait until we get more definite evidence. I feel that we should remove all teeth which are questionable, and think we are justified in leaving certain teeth which appear to be healthy to see if the general condition improves; then, if the results are not satisfactory, they may be removed.

I think Dr. Waddell and Dr. Gillett can be answered together. I have not done any root work for a long time but there are many cases where seepage into the root canal is not encountered. As I remember they are the exceptional cases. Dr. Gillett's method in closing such an apex with gutta percha, and filling against it with copper amalgam, is excellent. If you are going to do a root resection there is nothing better than copper amalgam sealed in, as Dr. Gillett suggested. I do not think it is good surgery to fill the root canal and then do the resection at the same time. Even the method of sealing up the apex with copper amalgam at operation is prejudicial. The less the manipulation, the better the results.

A CROSS-SECTION THROUGH PRESENT-DAY THOUGHT IN DENTISTRY[1]

Reports on Responses to Questionnaires

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New York City

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I. GENERAL DENTAL PRACTICE

William Dwight Tracy, D.D.S., F.A.C.D.

The questionnaire on general dental practice was sent to a selected list of fifty men including professors of operative dentistry and prominent practitioners throughout the country. This report is compiled from the forty-one replies that were returned.

Question 1. "*Do you consider that there is danger of over-specialization in the profession of dentistry?*" (*a*). "*In what particular?*" (*b*). "*With what result?*"

The majority, in answering this question, seem to feel that there is danger of over-specialization, but practically all are agreed that the specialist in dentistry is an absolute necessity and of unquestioned value to dentistry as a profession and to the public as well.

[1] Read at a meeting of the New York Academy of Dentistry, January 28, 1926. This symposium was compiled by five authors, each of whom prepared a questionnaire of ten questions dealing with the problems of his specialty, and mailed it to a group of men he selected as being most prominent in his special field.—(Ed.)

Under "(*a*) In what particular?," the suggestion is made that it seems to be too easy for a man to pose as a "specialist" in any one of the special fields of endeavor in dentistry without proper qualification; and that even among specialists of high repute there seems to be a tendency to emphasize and exaggerate the importance of that departure from the normal which comes within their field, at the same time overlooking other lesions of equal importance. If specialists were men who had first had a broad experience in general practice there would be less danger of the single-track mind among them. Many of the most successful specialists throughout the country are thus qualified, but on the other hand many appear in our ranks as specialists who are inadequately equipped and whose perspective on the broader and more general phases of dentistry is warped or altogether undeveloped.

Under "(*b*) With what result?," one correspondent suggests that, if the present tendency persists, we will ultimately reach a point where dentistry will be permanently divided into many special fields, and that dentistry by specialists only will mean higher fees and greater difficulty for the general public to obtain proper dental attention. Over-specialization may be deterimental to the best interest of the patients because of too great a zeal on the part of some men to pursue their own line of thought and action independently of all other considerations. Qualifying clauses in some answers indicate a rather widespread opinion in favor of most of the standard specialties of today for the larger cities while citing the great necessity for competent general practitioners of dentistry in the smaller cities, towns, and villages.

The conclusion of the writer is that the breaking up of dentistry as we knew it thirty years ago, into several special fields of work as we find it today, is a normal result of the evolution of dental science It is no longer possible for one man to master thoroughly all branches of dentistry and the specialist is one of the concomitant results of progress. The so-called general practitioner will always be needed to give that general care and oversight so essential to the welfare of all patients, and to correlate the various syndromes and symptoms and refer to specialists when necessary. In the smaller communities the general practitioner must cover the general field as best he can. Even

today many men are doing various types of work that in the larger centers are gladly referred to specialists simply because they are available and economic conditions are such that patients desire the best that the profession can offer.

Question 2. "Do you think that the members of the dental profession are sufficiently careful in their methods of making an oral and dental examination?"

Out of the forty-one replies to this question only one correspondent answers yes and his yes is accompanied by a qualifying clause. The consensus of opinion is that this detail in the routine of daily practice is sadly neglected, and many interesting and thoughtful replies to the questions were received. In order to illustrate the wide range of thought on this point the following quotations are made.

"Standardized procedure for the use of all is recommended."

"Oral prophylaxis should always precede a dental and oral examination."

"Examinations are slipshod, incompetent, and lacking in system."

"Dentists who report that cavities are present, but that they are too small to bother with, give evidence that they have no prophylactic sense."

"Examination of the teeth is one of the weakest spots in the entire gamut of dental practice."

"Many lesions are overlooked, which, if observed in time, would prevent serious involvement. This is particularly true of periodontal lesions."

"Dental examinations may be complete, but too often oral examinations are incomplete. Two classes of careless examinations: One by the man who is over-worked and one by the man who uses advertising methods. Oral prophylaxis for every mouth, which should include a searching examination for defects and incipient caries, is recommended."

Some of the replies advanced reasons for so much neglect in this important and exacting part of our work. One correspondent suggests that a careful dental and oral examination is of fundamental importance to any patient applying for treatment and advice, but that many practitioners hesitate to make an adequate charge for this service and that therefore it is done in a casual manner.

"The necessity for the careful consideration of all cases before operation, is not debatable."

"Taking time for an exhaustive examination an exact diagnosis must be taught in our dental schools as an item of the greatest importance."

"If dentistry is to maintain an important place in public health service, oral examinations based upon a proper knowledge of the fundamental sciences will be required of the dentist in the immediate future."

These criticisms constitute rather a severe arraignment of the rank and file of dentists. Unless this evident laxity is eliminated, we may soon have a large corps of specialists in "dental examination." However, there is a note of hopefulness in the situation. The very fact that so many prominent men in the profession are earnestly advocating greater care in the making of dental and oral examinations indicates a trend toward greater interest. By the use of the extra-fine exploring points, as advocated by Dr. Gillett, the mouth lamp and x-ray studies made to show the crowns of teeth, thus detecting incipient interproximal caries, we are able to accomplish better results today than ever before.

Question 3. ***"In the mouths of patients in good health what should be done with pulpless teeth in which an incomplete root-canal filling has been inserted several years previously, where the tooth is giving good service, and where radiograms taken at several angles disclose no evidence of pathological changes about the apex?"***

The point dealt with in this question is one that has been much discussed, and the replies indicate a unanimous opinion that teeth of this classification should be retained and kept under periodic x-ray observation. Several of the replies go somewhat into detail as to methods of management and procedure, as is illustrated by the following excerpts.

"When teeth present no obvious manifestation of disease and the patient exhibits no metastatic symptoms the teeth may be passed as non-pathologic. If such teeth are to remain, patients should be advised that the x-ray cannot prove absolute absence of infection, nor can it measure the infection that may be present or the degree of

toxicity that may be active." This writer states that he would not retain in his own mouth any tooth in which the pulp had lost its vitality under any circumstances.

"Our dental scientists have shown that a large percentage of such teeth as described prove sterile in culture. Grove and Davis have shown that, in a large percentage of teeth in this class, vital apical tissue has caused calcification and blocking off of all foramina, and it is therefore considered good practice to leave them *in statu quo*."

"If pulp canal is visible in the x-ray film beyond the end of the old root filling, possibility of future infection exists. The canal should be opened, and treated and completely filled to the apex, using bacteriological tests to ascertain when treatment has produced sterility."

"If the entire profession should decide that any and all teeth having lost the vitality of their pulps must be removed, we would not have to deal with this question or the many other complex questions that constantly arise concerning pulpless teeth."

It is writer's opinion that as long as root-canal therapy is practised, Question 3 will have to be decided according to the best judgment of the individual practitioner. The answers, however, show that opinion is pretty well crystallized in favor of watchful waiting. Some offer the general suggestions that the teeth should be opened, treated, and filled to the apex, if possible.

Question 4. "Is it ever justifiable to devitalize a normal dental pulp for the purpose of inserting a prosthetic restoration?"

The replies to this question are classified, as a matter of convenience, as follows: No, 17; yes, 4; questionable practice, 4; doubtful, 4; rarely, 12. In other words, seventeen answered "No" without reservation. Four answered "yes" with qualifying comment. Four opined that it was "questionable practice," with admissions that under certain conditions it might be permissible or even necessary. Four stated that, in their opinion, it was doubtful whether devitalization of a normal tooth was ever justifiable. Twelve seemed to feel that the procedure was rarely if ever justified. Comments quoted from some of the replies follow.

"Root-canal fillings have been done in the past which have stood the test of time. If devitalization is necessary for the proper construc-

tion of bridgework, and the dentist understands scientific root-canal technique, it is justifiable."

"I can understand how a skillful and careful operator may devitalize a normal dental pulp and properly fill the pulp canal without jeopardizing the health or life of the patient. It is unwise to say that it is never justifiable. In rare cases it may be of benefit to the patient, and this should be the deciding factor. Devitalization, however, should be done only after careful consideration and with a full appreciation of the gravity of the operation."

"I have never in fifteen years of practice devitalized a normal dental pulp. The conservation of the dental pulp is a fundamental precept upon which my treatment is based."

"Under exceptional conditions, and at the hands of a practitioner well skilled in root-canal technique, the practice is permissible. If conditions would permit of an effective and hygienic prosthetic restoration by some process not requiring pulp devitalization such devitalization should be avoided."

To sum up, then, it would seem that the consensus of opinion is largely against the devitalization of a normal pulp for any purpose, but several men consider it justifiable under certain conditions.

The conclusion reached by the writer is that all representative minds in the profession are definitely impressed with the necessity for maintaining pulp vitality where possible, and when all factors pertaining to the individual case have been considered. The divergence of opinion concerning this question is quite akin to that which is observed in all moot questions, and indicates a disinclination on the part of many to recommend or to accept a so-called "cut and dried" procedure for all cases.

Question 5. "What is the best filling material for general use in filling deciduous teeth?"

The answers to this question indicate a more or less uniform opinion among our correspondents that there is no one best filling material for deciduous teeth. This is the reaction that was anticipated. With few exceptions all replies included silver amalgam, and in most cases this material was given preference. Copper amalgam was second in popularity, the copper phosphate cements were third,

oxyphosphate of zinc fourth, gutta-percha fifth, tin and gold in combination was recommended by two men for small occlusal cavities, and soft gold foil for the same purpose was suggested by one. From this analysis it will readily be seen that the solution of this problem, like many another in dental practice, must be left to the judgment of the individual operator. The information gleaned, however, indicates that silver amalgam is probably more widely used in the filling of deciduous teeth than any other one material, and that copper amalgam is second in popularity, closely followed by the various copper cements now available together with gutta-percha and the other materials mentioned. The following quotation from one of the most carefully prepared replies is quite to the point.

"No one material may be called 'best.' High-heat gutta-percha, zinc or copper phosphate, or amalgam may be best in different types of cavities. In small occlusal pits and fissures nothing can equal tin foil, though it is now but rarely used. This material may be very speedily packed with wedge pointed pluggers and finished with a burnisher, and such fillings will outlast any other material except perhaps non-cohesive foil."

"Where possible use silver amalgam; in other cases, especially deep seated caries, use oxyphosphate of copper."

Amalgam with cement retention is suggested as insuring proper mesiodistal relations in molars and making deep undercuts unnecessary. Some of the replies entered into a detailed explanation of just where certain materials should be used, such as amalgam for the molars and gutta-percha or cements in the anterior teeth. The conclusions reached by the writer are that all competent dentists realize the necessity of safeguarding the welfare and integrity of the deciduous teeth; and that, among all of the available materials, silver amalgam offers the greatest number of advantages and seems to be most widely used.

Question 6. "At what age do you consider it wise to begin to insert permanent fillings in the permanent teeth of growing children?"

While there is a wide variety of opinion shown in the answers to this question, there is at the same time a certain unanimity of thought concerning the conservation of the dental pulp and the ultimate safety

of the tooth. The consensus of opinion is that no definite age can be stated as a reply to this question, although many say in general terms from fourteen to sixteen, qualifying their comments in many different ways. It is agreed that all pit cavities and fissures in permanent teeth should receive permanent fillings of gold or amalgam as soon as these defects are discovered. It is also agreed that caution should be observed in the insertion of large metallic fillings of any type where serious loss of dentine has occurred. To illustrate the wide range of answers given, a few are quoted as follows.

"Any time after the teeth are fully erupted, depending entirely upon the character of the development of the enamel, dentine, and pulp. The proper preparation of cavities should not cause too much pain or create psychological injury to the patient."

"About three to four years after the teeth are fully erupted."

"Small cavities should be permanently filled as soon as discovered. Deep cavities: not until sixteen years or older."

"Depends entirely on the temperament of the child. The character of the child, and the condition and environment of the teeth, are more important factors in reaching a decision than the mere matter of age."

"Permanent fillings should be placed as soon as conditions permit. All factors such as temperament of the child, ability of the operator successfully to control the patient, depth of caries, accessibility of the cavity, etc., must be considered. I do not think any definite age can be stated."

"Insertion of permanent fillings in the permanent teeth of children must be decided upon by the condition of the teeth themselves, and by the physical and mental condition of the child."

"Cavities involving serious loss of dentine should not be filled with any form of metallic filling before fourteen to sixteen years of age. Permanent fillings, where any large amount of dentine has been exposed, should not be inserted until complete development of the roots of the tooth has occurred."

It is interesting to note that many replies mention the psychological factor as being quite important in deciding at what age to undertake permanent work on the teeth of growing children. While certain fundamental principles relating to this question have been accepted by all, the only conclusion possible is that the question itself is likely

to be answered in the future as it has been in the past according to the operator's individual judgment.

Question 7. "What method do you use to sterilize dentine prior to filling cavities?"

In a large majority of the replies to this question, phenol followed by alcohol and warm air was mentioned first, several mentioning this method and no other. Agents mentioned for sterilizing dentine: Phenol and caustic potash, equal parts; phenol compound; swab with zonite; silver nitrate and ammonia; mercuric bichloride, 1 to 5,000 in 70 per cent grain alcohol; 10 per cent solution of formalin. In deep cavities, carbo-eugenol, sealed in for a week or more; or Neo-Balsam, into which a small quantity of powdered silver nitrate has been incorporated; 10 per cent silver nitrate; tricresol; formalin; creosote. The fact that these agents have been mentioned by our correspondents indicates a desire on their part to do what can be done to render the dentinal wall clean and if possible sterile before the insertion of the filling, but some of the comment that appears in the following quotations indicates an element of doubt concerning the possibility of sterilizing dentine.

"I feel that a cavity from which all decayed dentine has been removed does not need the use of a special disinfectant. Before filling, I wash all cavities with pure alcohol."

"I use the rubber dam—phenol may help."

"I do not expect really to sterilize dentine prior to filling cavities, and consider it impossible to do so in the average case. I consider the removal of disintegrated dentine, and cleansing and drying with alcohol or chloroform, to be as near to sterilization as is practicable."

"I know of no method that will insure complete sterilization of dentine, but I believe in the use of the rubber dam prior to the insertion of the filling material."

"We rely upon the dehydrating effect of pure alcohol with warm air. Care is taken, however, gradually to establish a sterile condition, by the removal of the infected debris and the use of sterile instruments as we approach the sound tissue."

"In shallow cavities thymol alcohol, in deep seated posterior cavities, ammoniacal silver nitrate precipitated by eugenol, if decay extends

dangerously near the pulp. As a capping: Steridenf No. 1 over the pulpal wall covered with oxyphosphate of zinc cement."

"Use no sterilizing method other than thorough removal of all carious dentine. In some cases solution of silver nitrate may be used but antiseptics as commonly used are in contact with the dentine for too short a time to be of any real practical benefit."

So again we see a wide variety of opinion and the actual procedure based upon the judgment of the individual operator.

Question 8. "Do you regard inlays and all-porcelain jacket crowns as important factors in the conduct of successful practice?"

The answers to this question have been more definite and therefore more easy to analyze and classify. Concerning the all-porcelain jacket crown, thirty-eight say "yes" and three say "no." Concerning the porcelain inlay, twenty-five say "yes," seven say "no," and nine are doubtful about its being an important factor in the conduct of successful practice. The jacket crown seems to have found its place in dental practice, and many of those voting "yes" emphasize their vote by saying "most emphatically," "I certainly do," "by all means," etc. Those who voted "no" did not state why. The porcelain inlay, while definitely supported by twenty-five affirmative votes, received seven adverse votes. With nine, its place as an important factor in dental practice seemed questionable. A few quotations follow.

"Porcelain-jacket crowns are most important. In my opinion this should be the 'standard type' and any other form should rarely be used as an individual crown."

"Porcelain inlays are moderately important."

"All-porcelain jacket crowns are extremely important factors. Porcelain inlays are often important factors, also, but some substitutes can frequently be used to good advantage."

"I think the jacket crown is the finest kind of restorative dentistry that can be done in a successful practice, but I seldom use porcelain inlays."

"The jacket crown is most valuable when used with judgment, but in my opinion there are very few cases where synthetic is not superior to porcelain inlays."

"Yes, and both should be more effectively taught in our schools and used more in daily practice."

"Yes, for the porcelain jacket, but I feel that porcelain inlays should be used solely for their esthetic qualities and confined to the anterior teeth."

The question arises whether the three who voted flatly against the porcelain crown understood the purport of the inquiry. This question was asked because of the fact that so many men in dentistry are not using the porcelain-jacket crown and porcelain inlays as a matter of routine practice. The conclusion of the writer, which is necessarily somewhat biased, is to the effect that both the porcelain-jacket crown and porcelain inlays are essential to the conduct of a successful practice.

Question 9. "What is your attitude toward prophylactic odontotomy?"

An analysis of the replies to this question shows the following tabulation: Favorable, 19; unfavorable, 6; doubtful, 6; no answer, 7; erroneous answers, due evidently to misinterpretation of the term, 2. There is undoubtedly a lack of complete understanding in regard to Dr. Hyatt's plan for the application of prophylactic odontotomy, but the scope of this report does not permit extended comment on this point. The appended quotations show the general trend of thought among our correspondents.

"No harm could possibly arise from this practice."

"It is a great step forward in preventive dentistry."

"Scientifically rational, but important in inverse ratio to the dental care the child is likely to get."

"I believe prophylactic odontotomy is merely a name given to what my very dear old teacher, Dr. G. V. Black, taught us in '*extension for prevention*.' His extension for prevention is of course much broader, as it includes all surfaces of the teeth, whereas this new term applies only to occlusal surfaces of bicuspids and molars. I have had opportunity to watch the work of quite a number of New York dentists and, to me, it is evident that a very small percentage of them understand in detail the term '*extension for prevention*.' If it were understood and practised, as taught by Dr. Black, I believe there would be

no place for "prophylactic odontotomy," as I consider it a duplication."

"Dental schools have for years been teaching that all occlusal surfaces in bicuspids and molars should be filled as soon as the finest explorer will 'catch.' The newer teachings of prophylactic odontotomy seem to advocate the same procedure, and with this I fully agree."

"Favorable—provided the practitioner knows a fissure when he examines it, and doesn't call every sulcus and groove a fissure."

"I am in favor of prophylactic odontotomy, and on consulting old records I find I have been practising it for twelve years. There is no doubt in my mind that its value as a conserver of tooth structure is very great."

"I do not favor the practice of cutting out and filling the fissures in children's teeth unless they are defective, or unless there is a marked defect in a proximal surface."

"I believe that any fault in occlusal pits or fissures should be discovered and obliterated by filling while at the "pin head" stage, the discovery and treatment of such initial decays being one of the most important duties of the dentist, but I do not believe in the deliberate cutting open of sound enamel along a developmental groove."

"As an accepted procedure to be taught and advocated, I believe prophylactic odontotomy would deprive the dental profession of what is now a very important consideration; namely, individual judgment. There is such a fine line to be drawn between the necessary and unnecessary that a loop hole is opened for the unscrupulous. The scrupulous practitioner is careful now, and it therefore would not alter his judgment."

"Prophylactic odontotomy should be used with discrimination, and only after careful study."

"Should be used only when it will surely be a distinct benefit to the patient."

"The practice of prophylactic odontotomy is far-fetched and faddy, and can be placed under the heading of 'crossing bridges before you get to them.'"

"Watch your step! Don't be too radical. All sensible preventive dentistry is good practice."

"I think the term prophylactic odontotomy is inconsistent and absurd."

"Filling faults and fissures has always been recognized as first principle."

From the foregoing quotations it will be noted that there is some confusion in the use of terms which, until eliminated, makes it impossible for men to understand each other in a discussion of this subject. It is the writer's belief that the principles propounded by Dr. Hyatt in his various presentations on this subject, if correctly understood and properly practised, would have a beneficent result.

Question 10. "What can we do to impress the members of the dental profession with the necessity of properly filling deciduous teeth in order to safeguard their integrity up to the time of their normal exfoliation?"

The replies to this question show an interesting variety of opinions. A few are optimistic, and suggest that dentists are giving more consistent and intelligent care to the teeth of growing children now than ever before. Others are pessimistic to a degree, and one says: "If the common sense of the individual practising dentist does not help in this matter, God alone can!" One is radical, and recommends putting negligent dentists in jail until they are ready to give children the same care and consideration that they give to the grown ups. Thought leading to constructive suggestion seems to center upon education and publicity, both in the profession and outside of it; and if the dentists now in practice, who know or should know what is required of them, cannot be interested to render proper service, we may still look forward hopefully to the rising generation of dentists who must be impressed with their responsibility. The rising generation of school children and their parents, who are steadily becoming more adequately informed concerning their dental welfare and needs, will force the dentist to give competent treatment to the teeth of growing children. A few quotations will illustrate the trend of thought among our correspondents.

"I do not know."

"Teach the colleges to teach the profession at its source."

"More patience on the part of dentists and more adequate remuneration for services rendered to children."

"Stress the subject before all dental societies as we teachers do in the lecture halls."

"The integrity of the individual practitioner must always be the controlling factor in doing the correct thing in practice."

"Keep on educating the school children until their own knowledge of their dental requirements will compel the laggards in the profession to give heed to their plain duty."

The writer's conclusion concerning the question is that, if a persistent campaign including all the suggestions here offered is pursued, in time a marked improvement in the mental attitude of the profession toward this important detail will result.

II. ORTHODONTIA

J. Lowe Young, D.D.S., F.A.C.D.

It would seem to be quite a simple matter to procure a cross-section opinion of various men throughout the country regarding ten questions. It was not a difficult matter to prepare ten questions that appeared to be satisfactory; but, from the answers received, it would seem it was far more difficult to arrange ten questions to meet with the approval of the various minds in the profession.

The questionnaire, consisting of ten questions, was mailed to seventy-three (73) men, and forty-eight (48) answers were received. In preparing these questions it was the aim of the writer so to word them that the answers thereto could be made very concise, and therefore be but a slight tax on the time of those to whom the questionnaire was sent, thus insuring a large percentage of answers. However, the forty-eight (48) answers were not received without additional effort; and while almost 66 per cent may be considered a good showing, it was the hope of the writer that a much larger percent would comply.

Question 1. "At what age do you prefer to have children placed under observation, if you are to be responsible for the occlusal relations of their teeth?"

No. of answers	*Reply*
2	One year
2	Two years
1	Two to three years
1	Two and one-half years
12	Three years
1	Three to four years
2	Three to five years
1	Three to six years
1	Three and one-half to four years
3	Four to five years
1	Four to six years
3	Five years
1	Five to six years
1	Five to eight years
1	Five and one-half years
5	Six years
1	Six to seven years
1	Eight years
1	Nine years
1	As early as possible
1	Just subsequent to infancy
1	At birth
1	When malocclusion is apparent
1	As soon as deciduous teeth erupt
1	I do not assume responsibility
47	

Forty (40) of forty-seven (47) advise that children be placed under observation prior to the sixth year. This is a little over 85 per cent, which we believe is conclusive evidence that the orthodontists favor having children referred to them at an early age.

Quesiton 2. "Is it part of your regular routine to procure a full set of dental radiograms of all children under observation and all cases requiring orthodontic treatment, before treatment is begun?"

No. of answers	*Reply*
26	Yes
11	No
7	No, but approve
1	Yes, when under treatment No, when under observation
1	Not always
1	Not answered
47	

Thirty-four (34) of forty-seven (47), or almost 72 per cent, of the answers were in the affirmative, and one in the affirmative for cases under treatment but not for cases under observation.

Question 3. "Do you advise expansion of the deciduous dental arches where no growth spaces occur in the incisal region about the time their permanent successors are to erupt?"

No. of answers	*Reply*
26	Yes
14	No
3	Not always
3	Occasionally
1	As a rule
47	

Twenty-seven (27) of forty-seven (47), or 57 per cent, favor such a procedure.

Question 4. "How young do you advise the beginning of treatment of cases in Class 1, Class 2, and Class 3 (Angle Classifications)?"

Class 1	
No. of answers	*Reply*
2	Three years
1	Four years
2	Five to eight years
1	Five and one-half years
2	Six years
1	Six to seven years
1	Six to eight years
2	Six to nine years
2	Seven years
2	Seven to eight years
1	Seven to nine years
2	Eight years
1	Eight to nine years
1	Eight to ten years
1	Nine years
2	Ten to eleven years
1	Eleven years
1	Eleven to twelve years
8	As early as possible
1	As soon as diagnosed
3	Condition, not age
2	Cannot answer
1	Cannot set age
1	Early
1	As soon as malocclusion is manifest
4	Not answered
—	
47	

Twenty-seven, or over 57 per cent, favor treatment prior to the end of the eighth year.

Class 2	
No. of answers	*Reply*
1	Three years
1	Three to five years
1	Three and one-half to four years
2	Four years
4	Five years
2	Five to six years
2	Six years
2	Six to seven years
1	Six to eight* years
2	Six to nine years
2	Seven years
1	Eight years
1	Eight to ten years
1	Eleven years
1	Eleven to twelve* years
10	As early as possible
1	As soon as diagnosed
2	Condition, not age
2	Cannot answer
1	Early
2	Cannot give age
1	Before six-year molars erupt
1	As soon as malocclusion is manifest
4	Not answered
—	
47	

*Six to eight and eleven to twelve—same answer, two periods.

Thirty-seven, or almost 79 per cent, favor treatment prior to the end of the eighth year.

Class 3	
No. of answers	*Reply*
1	Three years
1	Three to five years
1	Three and one-half to four years
2	Four years
6	Five years
2	Five to six years
3	Six years
1	Six to nine years
2	Eight years
1	Ten to eleven years
13	As early as possible
1	As soon as diagnosed
2	Condition, not age
2	Cannot answer
1	Early
2	Cannot give age
1	Before six-year molars erupt
1	Soon as malocclusion is manifest
4	Not answered
—	
47	

Thirty-three, or 70 per cent, favor treatment by the time the first permanent molars erupt.

Question 5. *"Do you believe that the third molars in eruption, or when malposed and fail to erupt, (a) exert a baneful influence on the other teeth; and if so (b) in what percent of cases do you find such influence exerted?"*

(a). *Influence*		(b). *Percentage*	
No. of answers	*Reply*	*No. of answers*	*Reply*
32	Yes	2	Small percentage
3	No	1	2 per cent
4	Doubtful	2	25 per cent
2	Yes, if malposed	2	50 per cent
1	No, unless malposed	2	75 per cent
1	Rarely	1	Very large percentage
1	In some cases		
1	No; yes	37	Not answered
2	Not answered		
47		47	

Thirty-seven (37), or about 79 per cent, answer in the affirmative, but only eleven, or 23 per cent, gave a percentage.

Question 6. *"What is your conception of normal occlusion of the teeth?"*

Forty-three (43), or over 91 per cent of the answers, showed conclusively that those who gave the answers had a proper conception of normal arrangement of the human teeth. No two of these answers were alike, except where a reference was made to some author's definition as being suitable for their purpose.

Question 7. *"Are you convinced that improper diet adversely effects normal eruption of the teeth and normal arch development?"*

No. of answers	*Reply*
39	Yes
2	No
3	Doubtful
2	Don't know
1	Not answered
47	

Thirty-nine (39), or almost 83 per cent, are in the affirmative.

Question 8. *"Do you think it feasible to put all human dentures in a balanced occlusion?"*[2]

No. of answers	*Reply*
14	Yes
26	No
2	As a rule
3	Doubtful
1	Balanced: yes Normal: no
1	Not answered
47	

Seventeen (17), or 36 per cent, answered in the affirmative.

Question 9. *"At what age have you found it no longer feasible to correct malocclusion?"*

No. of answers	*Reply*
1	Fourteen years
1	Fifteen years
1	Eighteen years
3	Twenty-one years
1	Twenty-nine years
2	Thirty years
1	Thirty to thirty-five years
1	Forty years
29	No age limit
6	Depends on the case
1	Don't know
47	

[2] A definition should have been given with the questionnaire. Anthony's Dental Dictionary does not define balanced occlusion, and I will therefore give my conception of this term as follows: "Balanced occlusion of the human dental apparatus is that arrangement of the teeth of the maxilla and mandible which provides freedom from cuspal or incisal interference when the mandible is in centric, or any eccentric position, and which provides that all of the teeth in one jaw are in perfect coördination with all of the teeth in the opposing jaw—a condition which is extremely rare in the human dental apparatus. This term was originally applied to the arrangement of teeth in artificial dentures. We believe this is the only relation where it should be used."

Twenty-nine (29), or almost 62 per cent, answer that they have not found an age limit.

Question 10. "Do you favor maintaining spaces left by premature removal of deciduous canines and molars?"

No. of answers	*Reply*
43	Yes
2	No
1	Sometimes
1	Not in well developed arches
47	

Forty-three (43), or 91.5 per cent, answer in the affirmative.

III. PERIODONTIA

Arthur H. Merritt, D.D.S., F.A.C.D.

In harmony with the plan outlined by the officers of the New York Academy of Dentistry, a letter was prepared and sent to those throughout the United States and Canada who were known by your correspondent to be engaged in the practice of periodontia, and believed by him to be the leaders of thought in this specialty of dentistry. Of the fifty-three to whom letters were sent, forty replied. If this seems a small number, it must be remembered that periodontia is one of the youngest of the specialties in dentistry, and that the number engaged in its practice is comparatively small.

Question 1. "What do you regard as the chief etiological factors in suppurative periodontoclasia? Please name them in the order of their importance"

As might be expected from the question and the complex nature of the etiology of periodontoclasia, many causes are ascribed to it, which are here enumerated in the order of the frequency with which they were mentioned, it being remembered that each writer makes mention of several causes: Traumatic occlusion, 20; bacteria, 18; oral uncleanliness, 15; poor dentistry, 14; diet, 12; tartar, 11; lowered resistance, 9; trauma as applied to the soft tissues, 9; systemic dis-

orders, 9; mal-occlusion, 7; bad contact points, 6, lack of functional exercise, 6; malnutrition, 5; tooth loss, 3; heredity, 3.

Quotations from the answers

R. G. Hutchinson, Jr.: "Chief factors are trauma and unsanitary conditions. The former, mainly through interference with circulation and the latter in providing culture media for bacteria."

Benjamin Tishler: "Traumatic occlusion, bad hygiene, constitutional disturbances, diet, and bacteria."

Julian Smith: "Mechanical and chemical irritation of gingivae, plus bacterial invasion."

John O. McCall: "Traumatic occlusion, deposits, infection, defective approximal contacts, incorrect use of tooth brush, defective nutrition, systemic disease."

R. W. Bunting: "Overgrowth of proteolytic bacteria, trauma, systemic prediposition."

H. J. Leonard: "Bacteria, traumatic occlusion, low cell vitality."

Austin F. James: "Lack of function, improper foods and sweets that make good bacterial media."

J. D. Patterson: "Anything that will prejudice or destroy the integrity of the gingival border."

Olin Kirkland: "Dietary habits of civilization and poor circulation, due to insufficient exercise of jaws and teeth."

Conclusion

The etiology of periodontoclasia is a complex one in which local mechanical and bacterial irritants play the important part. Predisposing factors are to be found in modern habits of civilization and systemic disorders.

Question 2. "What has been your observation regarding traumatic occlusion as a causative factor?"

Replies to this question were as follow: An important factor, 19; an important factor in some cases, but not necessarily a primary factor, 9; an unimportant factor, 4; an effect rather than a cause, 2; a contributing cause, 2; evasive, 2.

Quotations from the answers

G. R. Warner: "An important factor in many but not in all cases."
M. H. Garvan: "A definite factor."
H. DeW. Cross: "Secondary only."
P. R. Stillman: "Invariably a part of the etiologic picture; the most important factor."
LeRoy S. Edwards: "An effect rather than a cause."
A. J. McDonagh: "If you mean the fanciful, potential traumatic occlusion so much talked about, then it is an almost negligible quantity."
J. L. Williams: "A potential factor in some cases."
J. O. McCall: "The most important single causative factor."
C. B. Fowlkes: "Present in a majority of cases."
Elmer S. Best: "A more frequent cause than any other."
F. S. McKay: "Not convinced that traumatic occlusion is the chief or even one of the chief factors."
Olin Kirkland: "A contributing cause."
W. Yeretsky: "Few cases, where more than one tooth is involved. Never justifiable to grind all the teeth in a mouth for better occlusion."
Jules J. Sarrazin: "Most important: secondary only to infection."
Robin Adair: "Generally a result rather than a cause."
J. D. Patterson: "A small factor."
R. G. Hutchinson, Jr.: "The main factor."

Conclusion

An important etiological factor; may be an effect rather than a cause.

Question 3. "Have you any knowledge which leads you to believe that periodontoclasia is of systemic origin?"

The answers to this question were, as might be expected, generally expressions of personal opinion rather than of knowledge based on experience, and were as follows: No knowledge, 9; no knowledge, but systemic conditions believed to be an important factor, 18; no knowledge, but systemic conditions believed to be a factor under some con-

ditions, 6; no knowledge, but systemic conditions believed to aggravate and so affect prognosis, 7.

Quotations from the answers

F. H. Skinner: "Only lack of immunity to infection has a bearing on it."

T. Sydney Smith: "The more efficient one becomes in treatment the less frequently is he led to suspect some obscure systemic cause."

R. G. Hutchinson, Jr.: "No, cannot be the origin of the local disturbances."

M. Giesecke: "No knowledge or belief that it is ever of purely systemic origin."

R. W. Bunting: "Plays an important part in every case."

F. A. Bricker: "No proof, but believe malnutrition and use of certain drugs a very important factor."

C. S. Kramer: "No; except in tuberculosis and diabetes."

Olin Kirkland: "Not an important factor."

J. O. McCall: "Have seen cases which I could explain only on the basis of a systemic factor."

A. J. McDonagh: "Yes; many in my practice."

Paul R. Stillman: "Discount the claim of systemic derangement as an important factor in etiology. None can omit local factors and be successful in treatment."

Julian Smith: "No; would class it as contributory."

F. C. Pague: "No; have never seen a case of pyorrhea of other than local origin."

Conclusion

There seems to be no exact knowledge that periodontoclasia is of systemic origin, although several express the belief that it may have such an origin, while most seem inclined to the belief that systemic conditions may aggravate symptoms and unfavorably influence prognosis.

Question 4. "Do you regard non-replacement of an individual tooth an important etiological factor in periodontal diseases?"

Answers: Yes, 20; no, 4; depends on the case, 16.

Quotations from the answers

I. Hirschfeld: "One of the most important local factors."
T. Sydney Smith: "Usually an important factor."
Gillette Hayden: "Yes; in most cases."
F. S. McKay: "Do not consider it important."
S. J. Rauh: "Depends entirely on the case."
G. R. Warner: "In a majority of cases."
P. R. Stillman: "To neglect to quickly replace a lost tooth can only be explained by ignorance on part of dentist, poverty on part of patient, or culpable carelessness on part of both."
J. D. Patterson: "Do not consider non-replacement of an individual tooth an etiological factor."

Conclusion

A small majority regard non-replacement an important etiological factor, a considerable number believe it unimportant, while many are of the opinion that it depends upon the case in hand.

Question 5. "Outline briefly the treatment of periodontoclasia employed by you and found to be successful"

The answers to this question may be epitomized as follows: Removal of all irritants—traumatic, calculary, and bacterial; and the maintenance of a high standard of hygiene through oral prophylaxis, and intelligent home care.

Quotations from the answers

F. S. McKay: "The one prime requisite is complete obliteration of gingival irritation of whatever nature, and the maintenence of the mouth in the condition thus established."
C. H. Schott: "Thorough apoxesis, relief of occlusal trauma, proper home care, suggestions as to diet, emphasizing the importance of thorough mastication and drinking of sufficient water."

J. O. McCall: "Correction of traumatic occlusion, prophylactic treatment of entire mouth, instruction in the use of tooth brush, apoxesis of all pockets, prophylactic treatments at intervals of one to six months."

Benjamin Tishler: "Case history, radiographs, casts, prophylactic treatment, correction of occlusion, currettement of root surfaces, instruction in home care, and extraction of hopelessly diseased teeth."

H. DeW. Cross: "Clean up mouth and change diet."

Paul R. Stillman: "To maintain health, teeth require in treatment an innocuous mechanical relation of occlusion, freedom from all accretions, and daily stimulation of their blood supply in addition to that which eating produces."

M. H. Garvan: "Adequate history, complete x-ray examination, prophylaxis, instruction in diet, correction of traumatic occlusion, apoxesis, drainage of deep pockets by surgical interference when indicated, use of drugs only as an accessory, direction as to home care."

Conclusion

The chief recommendation is local treatment, consisting of a painstaking curettage of the involved root surface, correction of occlusion, the maintenance of a high standard of oral hygiene, and the stimulation of the circulation through the intelligent use of the tooth brush. Instruction in diet is recommended by some. No dependence is placed on drugs or vaccines.

Question 6. "Except in occasional cases, do you regard obliteration of pocket by gum resection, or treatment by so called 'flap operation,' good practice?"

Answers: Yes, 5; no, 32; evasive, 3.

Quotations from the answers

T. Sydney Smith: "Gum resection is unnecessary and unscientific. Gums mutilated in this manner cannot perform their function. This is one of the many harmful passing fads, such as spacing

teeth by cutting away contact points, early extraction of sixth-year molars, wholesale removal of pulps, etc."

J. D. Patterson: "Gum resection and 'flap operations' are, in my opinion, close to malpractice."

F. H. Skinner: "Have never seen a case in which I thought gum resection would be of any benefit."

Robin Adair: "About the only cure I know."

H. J. Leonard: "No; I believe this operation usually unnecessary; that it does much harm in removing valuable covering tissue; and that it lends itself to charlatanism of the worst type. It also disregards the possibility of re-attachment, now a proven reality."

Peter Treleaven: "I regard either as good practice; ordinarily prefer 'flap operation.'"

R. G. Hutchinson, Jr.: "Emphatically, no. Interference with living tissues should always be reduced to a minimum."

Olin Kirkland: "Do not think it possible to obtain satisfactory results without gum resection. Regard the 'flap operation' as a necesity in all cases of deep seated lesions."

Jules J. Sarrazin: "It is burning the stable to roast the pig."

A. J. McDonagh: "Employ gum resection very rarely."

Paul R. Stillman: "Not good practice. Seldom, very seldom necessary. Always leaves teeth infirm."

F. C. Pague: "Yes; and it is my practice."

M. H. Garvan: "In deep pockets find surgical interference radical enough to secure free drainage, and confined chiefly to lower teeth a great aid to treatment."

Conclusion

The great majority are in favor of conservative treatment, depending upon surgical interference only in occasional cases.

Question 7. "Do you regard drugs or vaccines of any special value in treatment?"

In tabulating the replies to this question it was found necessary to divide them, as there was a diversity of opinion regarding the relative value of drugs and vaccines. The replies were as follows: Those

favoring *vaccines*, 4; opposed, 29; believing they have supplemental value, 2. Those favoring the use of *drugs*, 1; opposed, 21; believing they have accessory value, 15.

Quotations from the answers

F. A. Bricker: "No; emphasis on the 'no.'"

H. J. Leonard: "No; except in Vincent's infection. Vaccines have been proven valueless in periodontoclasia."

Peter Treleaven: "Do not regard drugs, vaccines, or tooth paste of any special value."

R. G. Hutchinson, Jr.: "No; drugs have no value whatsoever."

E. M. Quimby: "In certain cases stimulation through the use of drugs and vaccines may be helpful."

Gillette Hayden: "Do not use either."

Robin Adair: "Vaccines, no; proper medication, certainly."

F. S. McKay: "Do not regard drugs or vaccines of the slightest value."

J. O. McCall: "My experience with vaccines has indicated that they usually help in building up resistance. Use it only in cases of evident lowering of general resistance."

Benjamin Tishler: "I use neither drugs nor vaccines."

S. J. Rauh: "Vaccines, no; drugs have their place in treatment."

M. M. Dixon: "Vaccines, no; drugs to a limited extent."

Olin Kirkland: "Drugs and vaccines, in my opinion, are of no value."

Paul R. Stillman: "Except in Vincent's infection, almost never use drugs. Have seen so little value from the use of vaccines, have given up hope of their ever giving me help."

F. C. Pague: "Certain systemic conditions can be greatly improved by vaccines."

M. H. Garvan: "Regard a few drugs as helpful. Have tried vaccines and found them disappointing."

Wm. A. Jaquette: "Drugs of slight value; vaccines of no value."

J. L. Williams: "Drugs, no; vaccines in stubborn cases seem worth while."

C. H. Schott: "Have not found vaccines of any value."

Conclusion

Neither drugs nor vaccines are believed to have any special value in treatment. A minority believe they may have a slight supplemental value.

Question 8. "Do you believe periodontia should, as a rule, be practised as a specialty, or should it be made a part of general practice?"

Answers: General practice, 18; a specialty, 13; evasive, 7.

Quotations from the answers

M. M. Dixon: "A specialty. Same as other specialties in dentistry and medicine."

J. O. McCall: "Can be practised most successfully by the specialist. Incipient and moderately advanced cases should, however, lie within the technical range of the general practitioner, provided his knowledge of occlusion is adequate."

A. E. Webster: "The disease is so common, it must be met by the general practitioner."

Austin F. James: "Specialization in advanced cases."

H. J. Leonard: "Dental periclasia is so prevalent that its treatment constitutes too large a part of the care of patients to relegate it entirely to specialists."

Paul R. Stillman: "Every dentist should be a qualified specialist in periodontia. It should be the foundation of all practice. It is doubtless true that the specialist will still survive, if that state were to become a fact."

A. J. McDonagh: "Should be practised as a specialty, but every dentist should have a knowledge of periodontia and make it a part of his general practice."

M. H. Garvan: "General practice. However, in large centers, there appears to be a very definite place for the specialist in the treatment of unusual and more difficult cases."

F. H. Bricker: "Specialization, but believe one should continue in general practice at least eight or ten years before specializing."

Gillette Hayden: "To be determined by location and individual talent."

R. W. Bunting: "It should be both."

Conclusion

Periodontia should be a part of general practice, though there will always be room for the specialist, particularly in the treatment of unusual and advanced cases.

Question 9. "What do you recommend in the way of post-operative care?"

Answers: All are agreed that efficient tooth brushing, massage of the gums in such a way as to promote circulation, and periodic visits for prophylactic treatment are important.

Quotations from the answers

T. Sydney Smith: "As soon as re-attachment has taken place, the teeth are thoroughly polished and detailed instructions in home care are given."

F. A. Bricker: "Home care by the patient. Prophylactic treatment every three or four months, if necessary; re-enthusing of patients in the importance of home care."

Austin F. James: "Fifteen minutes a day—five minutes, three times a day—using proper brush technique."

E. M. Quimby: "Strict attention to diet. Oral cleanliness. Periodical visits."

M. Yeretsky: "Efficient brushing four times daily, and massage with normal salt solution once daily."

J. O. McCall: "Checking up on occlusion occasionally, prophylactic treatments at intervals, insistence on correct brushing."

Benjamin Tishler: "Oral hygiene and gum massage. Moderate general exercise. Careful mastication, drinking of at least six glasses of water daily, and attention to diet."

A. J. McDonagh: "Massage by tooth brush, oral hygiene, instructions to patients to firmly close the teeth when swallowing."

Julian Smith: "Periodic visits, gum massage, and oral hygiene. Vigorous use of suitable mouth washes. Regard proper use of mouth washes of equal importance to use of tooth brush."

Conclusion

The maintenance of a clean mouth, through efficient home care and periodic prophylactic treatment, with such attention to diet and elimination as may be necessary, are generally recommended.

Question 10. "In your opinion, is the present undergraduate training in preventive periodontia adequate?"

Answers: Yes, 1; no, 29; evasive, 7.

Quotations from the answers

Elmer S. Best: "In view of the fact that dispensary patients are not satisfactory for educational purposes in the treatment of periclasia, I do not see how the undergraduate can be satisfactorily trained."

A. J. McDonagh: "That depends upon the college."

Paul R. Stillman: "It is not adequate; it is deplorable. A few schools have recently developed teaching in this branch to a point which is an improvement over the past. None are as good as they could be."

Benjamin Tishler: "Not at all adequate, but many schools are improving."

Olin Kirkland: "The training of the undergraduate in preventive periodontia is not at all in keeping with other fields in dentistry. In my opinion it is wholly inadequate."

F. S. McKay: "Is shamefully inadequate."

J. O. McCall: "Inadequate in a majority of the schools. Proper presentation of the subject to the undergraduate requires the establishment of a separate clinic in charge of a competent periodontist and the modernizing of the didactic schedule."

C. S. Kramer: "Woefully inadequate."

R. W. Bunting: "Usually not."

Robin Adair: "Absolutely no."

Geo. R. Warner: "It is in the school with which I am familiar and probably in many others."

E. M. Quimby: "More than inadequate. It is grotesque; it is a farce and a serious reflection on the intelligence and efficiency of the authorities concerned."

H. J. Leonard: "In my opinion, almost universally inadequate. In only a few schools is it well organized and even there the graduates do not seem able to practice it intelligently."

H. DeW. Cross: "In most schools, no."

T. Sydney Smith: "Far from adequate. Men who know so little about the functions of the gingival tissues, and care so little about their form that they deliberately remove them, should not be entrusted with the teaching of preventive periodontia. Where training is given, the methods taught are frequently harmful."

Conclusion

Those replying to this question are almost unanimous in the opinion that the present instruction in periodontia is far from satisfactory, though there is an undercurrent of belief that conditions are improving.

General summary of conclusions

1. It is evident that while progress is being made in our knowledge of the etiology of periodontoclasia, there are still unknown factors which are believed to interfere seriously with prognosis and treatment. Belief in its complexity is indicated by the fact that fifteen different etiologic factors are mentioned.

2. There seems to be an increasing belief that mechanical incoordination of the inclined planes of the teeth, when brought into occlusion in the act of mastication, is an influential causative factor, although fifty percent of those making reply qualify their belief in its importance.

3. There is also a majority who favor the belief that periodontoclasia has a systemic origin, although curiously enough not one of those expressing this belief offers any *knowledge* in support of his belief—a further indication that there are yet many unsolved problems in its etiology.

4. A majority favor the belief that it is important that the space created by the loss of an individual tooth be promptly filled by an artificial substitute to prevent drifting, although there is a large minority who believe that this depends on the case in hand, and cannot be predetermined.

5. There is general unanimity of opinion that there is but one effective treatment; namely, curettage of involved root surfaces, correction of occlusion, good hygiene, and the stimulation of periodontal circulation through exercise of the jaws and teeth, supplemented by the intelligent use of the tooth brush. A few recommend changes in diet, but do not indicate what these changes should be. It is evident that dependence is mainly on local treatment, and that such treatment when skillfully carried out is generally successful, indicating apparently that the controlling etiologic factors are local rather than systemic.

6. It is also evident that the vast majority of those engaged in the practice of periodontia in this country, and in Canada, do not favor radical procedures. Very few approve of gum resection as a routine practice, expressing the belief that the less trauma produced in operating the better. This is most significant, coming as it does from those generally recognized as authorities on the subject.

7. It is also significant that dependence in treatment is no longer placed on drugs or vaccines by the recognized authorities in periodontia; and that there are relatively few, among those replying to the questions, who regard vaccines as having even supplemental value. This is most encouraging, and should be a lesson to the rank and file of the profession, who in their ignorance of the principles of periodontia, swell the bank accounts of the nostrum venders at the expense of their patients.

8. All are agreed that the general practitioner should possess a wider knowledge of periodontal diseases, and should be more alert to their prevention. The belief is also expressed that there will always be a place for the specialist, to whom advanced cases, beyond the skill of the general practitioner, may be referred.

9. There is also general agreement that the post-operative care of the patient should consist of the application of the principles of mouth hygiene through intelligent home care, stimulation of periodontal circulation, and periodic visits for prophylactic treatment.

10. With the exception of one correspondent, who points to his own school as an example, and a few who are evasive, all are of the opinion that the present undergraduate training in preventive periodontia is far from satisfactory. It is significant that several of those

answering in the negative are teachers in some of our leading dental schools.

In conclusion your correspondent wishes, in the name of the New York Academy of Dentistry, to express thanks and appreciation to all those who contributed of their time and knowledge to the success of this report. If it possesses any merit, the credit is theirs and not your correspondent's.

IV. ORAL SURGERY

Harold S. Vaughan, M.D., D.D.S., F.A.C.S.

The questions on oral surgery, ten in number, were sent to forty men throughout the country who are engaged in this special work. Fifteen answered the questionnaire, ten asked to be excused for various reasons, the remainder failed to reply. It is not possible to publish all of the answers received for each question, but a certain number have been selected to reflect the various opinions.

Question 1. "What factors influence your choice of anesthetic in oral surgery operations?"

Quotations from the answers

Leon Harris: "I use novocain in all oral operations except in the following cases, when I use nitrous-oxide:

(a). Acute alveolar abscess where one or more teeth are involved.

(b). Infected third molars where the teeth are loose, and there is trismus necessitating forced opening of mouth.

(c). Cases of marked pericementitis of one or more teeth.

(d). Very nervous individuals who cannot be persuaded under any circumstances to take novocain.

(e). Very young children, where the teeth are not too much broken down."

A. Berger: "(a). The safety and efficacy of the anesthetic to be used.

(b). The nature of the operation to be performed based upon the pathological condition.

(c). The time necessary for the operation.

(d). The facilities for the operation and anesthesia.

(e). The general health of the patient.
(f). The age of the patient.
(g). The mental state or the psychological balance which may exist in the patient.
(h). The desire of the patient."

M. N. Federspiel: "Age, physical findings, prejudice, the type of the operation, and the local pathological findings. In my practice I depend upon the following anesthetics to do my work—procain, nitrous oxide, and ether."

Arthur B. Crane: "Conduction anesthesia is preferred for routine cases. Gas-oxygen is administered for short operations to young children, and to patients who wish it because of previous successful experiences. Intra-tracheal ether anesthesia is used for prolonged operations where conduction is contraindicated."

T. L. Gilmer: "Nature of operation, age of patient, physical condition, and whether it is a major or minor operation. Local for removal of impacted teeth, unless patient is unusually nervous, then ether. Gas for short operations."

B. B. Palmer, Jr.: "The factors governing the selection of the anesthetic are (1) the general condition of the patient, and (2) the local condition to be operated upon. Everything else being equal, I favor local anesthesia for operations of ten minutes or more. Local anesthesia for excessive cigarette smokers because they are poor nitrous oxide-oxygen subjects. Nitrous oxide-oxygen should be used in cases where it is highly desirable to avoid even a slight psychic shock, including the pregnancy cases. I like local anesthesia, in diabetic and low blood-pressure cases; nitrous oxide-oxygen in nephritic cases. There can be no set rule in the selection of the anesthetic, and in every case the advantages and disadvantages of each anesthetic must be weighed and the decision of choice based on two counts: the safety of the patient and the operative convenience, efficiency, and result."

Robert H. Ivy: "Local anesthesia is chosen for all minor and some extensive oral surgery operations, in the absence of acute inflammation, and where the mouth can be sufficiently opened to make proper injections. This form of anesthesia provides a practically bloodless field, permitting better view of conditions,

and allows plenty of time. General anesthesia is indicated in cases of acute infection in which it would be impossible to inject a local anesthetic except into the acutely inflamed tissues; where muscular relaxation is required to get the mouth open; in children and nervous adults who cannot be controlled under a local anesthetic; prolonged and extensive operations where duration of time and amount of tissue involved are beyond control by a local anesthetic."

Conclusion

Briefly, it seems to be the consensus of opinion that local anesthesia is favored in office work, for slight as well as more extensive operations, especially where the element of fear is not too marked; Nitrous oxide-oxygen, for the shorter operations and for infected cases, especially where they cannot be covered by nerve blocking. Some of the answers point out the general systemic diseases and conditions that indicate and contraindicate the various anesthetic agents.

Question 2. "Under what conditions is the operation for root-apex resection advisable, and which teeth offer the best chances for success?"

Quotations from the answers

Leon Harris: "Root resection, in my opinion, is advisable in all single-rooted teeth, which confines it to the anterior teeth where they have not been too much loosened by infection, and where the infectious process does not involve more than one-third of the root. The amount of involvement of the external alveolar plate should also be considered."

T. P. Hinman: "Under exceptional conditions, where it is imperative that the tooth be retained, and should be performed only on teeth with single roots."

M. N. Federspiel: "When there is no evidences of a diffused proliferative pericementitis or a gingivo-pericementitis. I have operated upon quite a number of teeth to amputate the root end wherein I was positive that the general findings of the tooth were healthy, except that there was a small circumscribed proliferative

pericementitis at the root end, or a root-end cyst, or a sharp angular curve at the root end. In cases where there is need for a root-end resection, we always ream out the canal at the same time that the root end is cut off. We have had excellent results with such cases during the last twelve years. All teeth showing evidences of a diffused proliferative pericementitis, whether vital or non-vital, are extracted."

T. L. Gilmer: "Root resection is indicated only in the incisors, cuspids, and bicuspids, and in those cases where only a limited part of the apex is denuded of its peridental membrane."

B. B. Palmer, Jr.: "I believe there is rarely an "advisable" case of root resection and only a limited number of *permissible* cases. In other words, I have come to the conclusion that all of the dangers attendant upon the retention of pulpless teeth are multiplied in the retention of pulpless teeth with a false apex not covered by peridental membrane. I take this attitude despite the fact that many cases of root resection which I did many years ago are still apparently in excellent condition. I believe that the apex-resection operation is too freely practised, and that it is not justified by physiological considerations. I believe that many operators are entirely sincere in performing these operations, but are misled by subsequent x-ray negatives into believing that the subsequent condition at the apex is normal."

Earle H. Thomas: "Until we condemn all pulpless teeth, I think that root-resection will, in a large percentage of cases, place the tooth in as healthy a condition as the average pulpless tooth. If the principle of the operation is correct, no one tooth offers better chances than any other. The lower teeth will give as good results as the upper. However, the operation is usually limited to the lower six anteriors and the upper bicuspids and six anteriors. When much more than the apical third of the root is involved, it might usually be better to remove the tooth."

Robert H. Ivy: "Root-apex resection is limited practically to upper incisors and canines with periapical disease not amenable to root-canal treatment alone, where not more than the apical third of the root is involved, and where the patient is otherwise healthy."

H. S. Dunning: "(1). Only in cases where there is little infection in

healthy individuals. (2). Would consider only the upper six anterior teeth."

Conclusion

Two of the answers opposed root resection under any condition while one regards the operation as rarely permissible. The remainder seemed to voice the opinion that as long as we consider it advisable to retain pulpless teeth, apical areas of infection can be removed by this operation, especially when the anterior teeth are involved.

Question 3. "Under what conditions should impacted teeth be removed, and when can they be retained?"

Quotations from the answers

Leon Harris: "I do not advise the promiscuous removal of impacted teeth unless definite symptoms are referable to them."

T. P. Hinman: "All impacted teeth should be removed, as they are always possible predisposing causes of neuritides and, occasionally, of mental disturbances."

A. Berger: "Whenever an impacted tooth is outside the possibilities of usefulness, and is prone to cause complications at a later date, it is best removed. This is especially true when this can be accomplished without jeopardizing any of the surrounding structures. From my experience I have found that the greatest number of impacted teeth cause trouble, if the patient lives long enough. They may have to be removed in later life when artificial substitutes must be worn. In many others, pathological complications develop, if left in place, which may be of a somatic or neuralgic nature."

"In older people, after the ages of 35 or 40, when an impacted tooth causes no trouble, or when its removal would entail a rather severe operation or the destruction of some essential and useful organ, and where there are no irritating factors such as a superimposed artificial denture, the impacted tooth may be left in place, especially when there are no disturbing symptoms."

M. N. Federspiel: "Removal of impacted teeth is indicated when their position is such as to cause mechanical irritation to the

neighboring teeth, when infected or when undergoing pathological changes."

Arthur B. Crane: "Should be removed only for objective or subjective symptoms."

T. L. Gilmer: "Impacted teeth should be removed only when there is infection due to partial penetration through the gum, or when there is pain which cannot be due to other causes than impingement by the impacted tooth on a nerve or against the root of the adjoining tooth."

B. B. Palmer, Jr.: "Impacted teeth cause so much trouble that I believe, when discovered in patients up to the age of twenty-five, they should be removed as a prophylactic measure. In older patients, when impacted teeth are discovered, I favor no interference unless there are local symptoms of discomfort or signs of local infection. I am opposed to the ruthless and unjustifiable removal of all impacted teeth. If a completely buried impacted tooth exhibits no symptoms during its first ten years after complete development, the odds favor its going along indefinitely without trouble. A partially erupted impacted tooth, however, is a far more dangerous tooth, as in these cases pockets of infection are frequently present and often give rise to acute widespread cellulitis."

Robert H. Ivy: "Removal of impacted teeth is advised where they are causing or suspected of causing local or general disturbances. I do not advocate removal of an impacted tooth just because it is impacted."

C. J. Lyons: "When there is evidence of pathological involvement. May be retained where there is no evidence of pathological involvement. Do not believe in removing as prophylactic measure."

Conclusion

Only one of the answers favored removal under all circumstances. Otherwise there is general unanimity of opinion that impacted teeth, when close enough to the surface to become infected, should be removed. They should also be removed when deeply within the bone, if associated with neuralgia and nervous disorders, or when by pressure they produce a crowding and interference with the dental arch.

Question 4. "What are the predisposing factors to the development of malignant neoplasms in the mouth that should be observed and corrected by the oral surgeon and dentist?"

Quotations from the answers

J. P. Henahan: "Any source of permanent irritation such as jagged roots, tartar accumulations, rough edges of fillings, crowns or plates, especially in unclean mouths."

T. P. Hinman: "Impacted teeth, chronic fistulae, roughened edges of broken roots and teeth."

Arthur B. Crane: "Every possible irritating factor should be eliminated. The whole mucosa should be minutely examined as a routine procedure."

T. L. Gilmer: "Leucoplakia; and, in a measure, chronic irritation caused by bridges, plates, or teeth with irritating edges. Experience leads me to believe that chronic irritation is not such a prolific cause of malignant growths as has been supposed."

B. B. Palmer, Jr.: "The principal causes of malignancy are the irritation of tartar at the gingivus, rough-edged unfinished gingival fillings, ill-fitting crowns of any type, depressed lugs and clasps of bridges and dentures."

Earle H. Thomas: "Anything in connection with the mouth or teeth where a chronic irritation is present, should be observed and corrected. I might call particular attention to the upper and lower third molars even though fully erupted, if they are causing any irritation whatever to the adjoining soft tissues. Also, that type of leucoplakia which predisposes to malignancy should be entirely removed."

H. A. Potts: "Any source of irritation should be removed. Leucoplakia should not be tampered with unless showing initial malignant change."

Robert H. Ivy: "Some of these factors are leucoplakia, irritation of soft tissues by sharp edges of teeth, crowns, fillings, broken roots, artificial dentures, and filth in the mouth."

H. S. Dunning: "Irritation, trauma, infection. These three factors should be removed by the dentist and oral surgeon."

Conclusion

This question was suggested with the idea of emphasizing the responsibility of the oral surgeon and dentist to observe and correct all sources of irritation about the mouth which might lead to the development of cancer, and to recognize all lesions of a suspicious character in their incipiency, so that the patient may have the benefit of early diagnosis and treatment.

Question 5. "What is your practice regarding the complete suturing of mouth wounds after operation, with special reference to impacted teeth, cysts, and root resections?"

Quotations from the answers

J. P. Henahan: "Suturing should not be done. Every wound inside the mouth is an infected wound. Suturing prevents natural physiological function of the soft tissues in reacting. Pressure is caused inside the wound and general symptoms are *nearly always* developed. Retaining stitches, one or two to hold flaps or lacerated parts in approximate position, are advisable."

Leon Harris: "I suture only those cases where a ligature is absolutely essential to hold together the reflected mucosa. Where the flap can naturally fall back in position and heal by primary union I omit suturing. When suturing any case, whether cyst or following root amputation, I always leave a small opening for drainage."

M. N. Federspiel: "Suturing should only be done in cases where it is necessary to replace the tissue so that function may not be interfered with, and when it is necessary artistically to shape to a more normal contour the part that had to be operated. When there is need for drainage, it is important and necessary that suitable provisions be made for proper drainage. Suturing should never be done to be spectacular—but always when it is practical."

Arthur B. Crane: "Immediate suturing of mouth wounds is desirable, but should be done in such a manner as to reduce blind spaces to a minimum."

T. L. Gilmer: "Wounds due to removal of small cysts, not infected, should be sutured. Partial suturing is indicated following removal of some impacted teeth. Suturing is indicated following root resection, but thorough irrigation with saline solution to remove particles of loose bone or tooth tissue must precede it."

B. B. Palmer, Jr.: "I rarely suture wounds of the mandible entirely, almost always leaving one area open for a protective dressing. In the maxilla I frequently suture, entirely, wounds of impactions and uninfected cyst cases. In the mandible there is a tendency for food to collect in the blood clot, with resultant breaking down and local sepsis. Another advantage of using a gauze dressing, particularly in wounds of the mandible, is the opportunity it affords to introduce slowly soluble anesthetics to alleviate pain."

Herbert A. Potts: "Always institute proper drainage where there is infection; in many other cases, a 24-hour or 48-hour drainage. Never suture after removal of third molars."

Robert H. Ivy: "In the case of impacted teeth, the wound is partially but not completely sutured, a small opening being left for drainage and irrigation if necessary. Wounds are generally sutured completely after cyst operations and root resections, if no acute inflammation is present. In all mouth operations the endeavor is to cover exposed bone by soft tissues as far as possible and obliterate cavities."

H. S. Dunning: "I suture most wounds, of moderate size, of the upper jaw, as I believe these can be left cleaner than lower jaw wounds. Seldom suture wounds in the lower jaw unless the dead space resulting is very small, probably less than one centimeter in depth or width."

Conclusion

The writer has seen many cases of osteomyelitis and other severe infections as a result of failure to observe the fundamental principles of surgical drainage. Owing to the fact that many articles have appeared in dental journals advising the complete suture of surgical wounds, especially after third molar operations, it seemed wise to obtain the opinions of the more experienced operators.

Question 6. "To what extent is it advisable to remove the alveolar process after removal of all teeth?"

Quotations from the answers

Leon Harris: "I remove sufficient alveolar process to do away with sharp edges under the gum, to insure a uniform ridge for a plate, and to eliminate uneven surfaces and hollow recesses."

T. P. Hinman: "This operation should be done with extreme care, and only a minor portion of the process removed."

A. Berger: "The removal of the alveolar process is advisable in those cases where more rapid healing of the parts is desired than may be secured by depending upon the resorption of the jagged bone processes by osteoclastic means. To correct an acquired or congenital malformation or irregularity in the alveolar outline, so that it affords a more favorable surface for the application of an artificial denture. Excessive removal and creation of a flat surface is a pernicious operation, doing more harm than good."

Arthur B. Crane: "A rounding off of the alveolus after removal of all of the teeth makes for a better post-operative result and quicker prosthesis; but extensive removal of alveolar process is injurious."

T. L. Gilmer: "Only to give a smooth surface to the edge of the process. In prognathous jaws, sufficient may be removed to afford better cosmetic effects."

B. B. Palmer, Jr.: "I believe it advisable to remove all high points of septum and sharp overhanging edges of the buccal plate. I do not favor ruthless destruction of process. It is sufficient if enough process is removed to insure a well fitting, comforable denture."

Herbert A. Potts: "Removal of alveolar process is a pernicious practice, except in carefully selected cases, which are rare."

Robert H. Ivy: "For most teeth, removal of alveolar process is limited to trimming off sharp edges after extraction. Where the process is dense, offering great resistance to extraction with danger of fracture of root, I remove part of the labial plate."

C. J. Lyons: "Much over done. Only lower portion of buccal alveolar plate on maxilla and upper portion on mandible should be smoothed off."

Conclusion

In the removal of all teeth in preparation for dentures, it is the practice of the careful oral surgeon to remove sharp alveolar edges and prominences to promote the formation of a sound alveolar ridge.

Question 7. "What is your attitude regarding the necessity for the curettement of irregular areas of lessened density in bone (so-called areas of retained infection), or the removal of dense areas (so-called sclerotic bone), as shown by the radiogram?"

Quotations from the answers

J. P. Henahan: "These conditions should have very careful consideration before resorting to surgical interference. I believe that many such *scenes* are due to insufficient x-ray examination. Operation for them has not shown very encouraging results."

Leon Harris: "Irregular areas of lessened density of bone, if not extensive, may be let alone, especially if they are not considered to be definitely infected; or if the patient does not complain of constitutional disturbances. Sclerotic areas I always regard as harmless."

M. N. Federspiel: "It is not necessary to curette areas of lesser density in bone, unless they are undergoing chronic ostitis. The removal of sclerotic bone is usually not indicated."

Arthur B. Crane: "This is being largely overdone. When such an area is cystic in character, or where it throws a shadow when transilluminated, curettement is justifiable."

B. B. Palmer, Jr.: "I am very conservative about plunging into areas of roentgen translucency. There *can* be a condition of retained infection in the alveolar process; and when it is definite, it should be eradicated. But about 95 per cent of these operations are a result of a combination of inexperience in diagnosis and a hunger for operating. I am not convinced that sclerotic areas in bone indicate the presence of infection, and I oppose operating upon them unless they are associated with neuralgic symptoms that cannot be due to anything else."

Earle H. Thomas: "Retained infection is not usually an 'irregular

area.' A large percentage of so-called 'irregular areas of lessened density in bone' is normal bone. Actual retained infection usually shows up very definitely outlined like a so-called granuloma and of course should be thoroughly curetted. Sclerotic bone in my opinion should not be interfered with."

Robert H. Ivy: "Residual areas of lessened density clearly defined by the x-ray should be exposed and the contents evacuated by the curette. Dense areas of sclerotic bone represent healed processes, are not sources of infection, and should be let alone unless causing pain from entanglement of nerve filaments."

Conclusion

The question was not well understood. It was submitted because of the large number of cases that come to the writer's attention, with radiographs that show cancellous areas in the bone, some of which may be sites of areas previously operated upon that have not filled in with dense bone, others are rather vascular areas that lack the characteristic line of demarcation seen in true cystic and cyst-abscess areas. Yet, these areas are classed as retained infection by the radiographer who has had no clinical experience. At times the experienced surgeon has difficulty in convincing the patient of the futility of opening into bone that he has found by past experience to be normal. The same considerations apply to the areas of dense bone.

Question 8. "What are the chief factors to be considered in determining the advisability of retaining or removing pulpless teeth?"

Quotations from the answer

T. P. Hinman: "Condition of the cemental apex. Physical condition of the patient. Gravity of the disease in which this focal infection may be a factor."

A. Berger: "The general health of the patient. The predilection towards diseases which may be ascribed to focal infection. The condition of the tooth itself. The degree of infection as evidenced by the amount of tissue destruction. The possibility of adequate root-canal therapy in so far as the tooth itself is concerned. The probability that thorough root-canal work will be

performed. The number of pulpless teeth present in the mouth. The importance of the tooth, that is, its functional value."

M. N. Federspiel: "Pulpless teeth that are undergoing chronic inflammatory changes should be removed."

Arthur B. Crane: "Pulpless teeth which are normal in function, which give radiographic evidence of absolutely normal arrangement of the periapical tissues, and which do not throw a shadow on transillumination, may be retained with safety. Teeth lacking these requirements may sometimes be successfully treated; if not, they should be extracted."

T. L. Gilmer: "Been unable to find any good results from removal of pulpless teeth when good radiographs show no signs of periapical infection. In order to be sure that infection does not exist, several radiographs should be made from different angles."

B. B. Palmer, Jr.: "The health of the patient should be the only factor to be considered. No pulpless tooth should, in my opinion, be retained in a case of systemic infection which may *possibly* arise from a primary focus. The laboratory evidence on cases of removed pulpless teeth, apparently well filled, and showing no definite areas of cell breakdown at the apex, is too definite to be ignored. Are we justified in gambling with a patient's resistance? Certainly all pulpless teeth showing definite evidence of infection should be removed."

Robert H. Ivy: "The general condition of the patient is the most important factor. Advise removal of all pulpless teeth, whether radiographically normal or not, in cases of systemic disease that might be caused or aggravated by infection from these teeth. In otherwise healthy patients, pulpless teeth without demonstrable periapical areas of infection can be safely retained. In cases showing lesser grades of periapical disease, root-canal treatment, root resection, etc., should be given a chance."

H. S. Dunning: "(1). General condition of patient, age, blood pressure, etc. (2). Amount of infection at apices, condition of mouth and teeth, condition of pulp or root filling, location of teeth, whether or not near antrum or other important cavities."

Conclusion

Among the fifteen answers to the above question, two favored removal of pulpless teeth under any and all circumstances. The consensus of opinion, however, seems to be that pulpless teeth without radiographic evidence of pathology may be retained, in persons showing no evidence of systemic disease that may be due to focal infection.

Question 9. "When diseased areas around the teeth extend to, but do not involve, the antral mucous membrane, what is your attitude about opening the antrum?"

Quotations from the answers

B. H. Harms: "The diseased area should be removed without penetrating the antral mucous membrane."

Leon Harris: "I do not open the antrum unless a sinus plate shows antral involvement."

T. Hinman: "Under these conditions, the antrum should never be opened, but the tooth removed and the socket curetted and drained."

A. Berger: "In the absence of positive signs of involvement of the maxillary sinus from the oral aspect, this cavity when intact should never be entered."

M. N. Federspiel: "It is a violation of the principles of surgery to open the antrum if that chamber is healthy. Extensive curettage has lead to a violation of these principles. I consider it nothing more than the spectacular action of the pseudo-surgeon who is attempting to play to the galleries. I have many cases to operate on each year where the antrum became secondarily infected from the cumbersome and crude methods of operation by the inexperienced."

T. L. Gilmer: "Consider it bad practice to open into the antrum under such circumstances."

B. B. Palmer, Jr.: "The antrum should never be deliberately opened in such a case."

Earle H. Thomas: "When it is necessary to curette granulomatous areas in contact with the antrum lining, they can be peeled away

without puncturing the antrum if care is used. It is nonsense to intentionally open into the antrum unless that cavity is infected."

Robert H. Ivy: "By all means keep away from the antrum, if at all possible."

C. J. Lyons: "Do not open the antrum. Many of these cases will repair with the drainage from the socket after extraction of the tooth. The antrum can always be opened, if it becomes involved. Opening should never be made through the tooth socket but through the canine fossa."

H. S. Dunning: "Cystic conditions often are near and press upon the antral floor. Open the antrum only when necessary for drainage, and when you feel that the disease condition may be draining into or communicating with the sinus."

Conclusion

This question was prompted because of the frequency with which the antrum is opened and often infected by indifferent curettement following the removal of infected molars and bicuspids. The answers indicate the procedure of the careful operator.

Question 10. "(*a*). *After the removal of pulpless teeth, do you regard the curettement of all sockets necessary?*" (*b*). *Do you believe it necessary to remove the surrounding bone by a flap operation or similar procedure, as a preliminary step to the curettement?*"

Quotations from the answers

T. P. Hinman: "(*a*). I do not. (*b*). I consider this operation, in a majority of instances, as malpractice. If the bone is osteoporitic, it may, in the judgment of the operator, be removed."

A. Berger: "(*a*). Not in all cases. Where there are pathological degenerations, or pathological tissue proliferations in the form of granulomata, or radicular cysts, these should be removed. (*b*). Flap operations are best indicated where the pathological area is not circumscribed and its extent is ill defined; and where the pathological area is of such size that complete eradication cannot be effected through the tooth socket. When it approximates some important structures, such as the maxillary sinus

or the inferior dental canal, and we do not wish to run the risk of involving these in our operative measures, it is best then to expose and visualize the field of operation, and operate under the guidance of the eye."

Arthur B. Crane: "(*a*). No, but a light curettement can do no harm. (*b*). Where the periapical area is much larger than the root diameter, the open-view operation is cleaner, and gives a better post-operative result."

B. B. Palmer, Jr.: "(*a*). Whenever infection is present, I curette the socket following the removal of the involved tooth. In the case of a pulpless tooth showing no x-ray evidence of infection, I always gently explore the area of the apex. If soft tissue is encountered (excepting at the floor of the antrum) it is removed and it is astounding how many times a granuloma is found. (*b*). I do not resort to flap operations for curettement unless it is impossible thoroughly to curette the infected area through the socket, in which case the flap is not only justifiable but necessary."

Earle H. Thomas: "(*a*). I am getting closer every day to the stage where I do not curette a socket unless, from the radiographic interpretation and clinical appearance, I think that the granuloma has developed a cystic lining. However, where large areas are present, I always instruct the patient to return in one year for a radiographic check-up. (*b*). I practically never use a flap operation for curettement. If one knows the correct method of curetting, he can usually curette a very large area through the socket, removing the entire granuloma in one piece so that he is sure it is all removed. When the area needing curettement is too large to curette thoroughly through the socket, I usually make a horizontal incision over the involved area and curette through this, thus leaving the gum margins intact."

Herbert A. Potts: "(*a*). I do not curette any sockets. (*b*). No, I do not."

C. J. Lyons: "(*a*). If a granuloma does not come out with the tooth, the socket should be curetted. (*b*). Only when there is extensive involvement of osseous tissue."

H. S. Dunning: "(*a*). No, as a rule do not. (*b*). No, only in cases of fairly large cystic areas."

Conclusion

The impression has been conveyed by some of the more radical dental surgeons that the bone around a pulpless tooth is nearly always diseased, necessitating an extensive surgical attack on the alveolar process after removal of the tooth. The answers indicate that such views are not held by oral surgeons of extended experience.

V. PROSTHETIC DENTISTRY

Edward Kennedy, D.D.S.

Fifty copies of the questionnaire were sent out and thirty answers were received. The questionnaire was sent to members of The American Society of Prosthodontists, which is composed of men who specialize in prosthetic work and are interested mainly in dental restorations. I also sent a number of copies to men in colleges who are listed as professors of crown and bridge work, but received no response from them. Therefore, I doubt if the response to the questionnaire is an exact cross-section of what is going on in the dental community. I have always doubted whether a questionnaire is the best way to obtain correct evidence of the methods and technique in the practice of dentistry. I believe a much better method would be to organize a representative group of men for the purpose of studying the restoration of selected cases by different methods, examining them from time to time, and tabulating the results. It is somewhat in this manner that the American Society of Prosthodontists is operating, and it is for this reason that I directed my questions mainly to this body of men. I wish to thank them for their very painstaking answers. Thus, we have the opinions of the best men in this speciality herein formulated; and, if we care to follow their suggestions, we certainly are not going far afield from the best methods.

The following is a tabulation of the answers to each question, and includes a quotation of the answer which best represents the general opinion of the group.

Question 1. ***"To what extent do you have the mouth surgically prepared before making dentures?"***

Answers: Radical preparation, 3; medium preparation, 18; minimum preparation, 3; no answer, 6.

Russell W. Tench: "Surgical preparation should be made only to the extent necessary to gain space to arrange teeth between the ridges and to remove spicules of bone that would cause discomfort when dentures are inserted within two weeks after extraction. Occasionally quite extensive removal of precess is indicated for esthetic effect, but this should be done only after a survey of the conditions has been made on study casts mounted in an anatomical articulator. For the average case at least two-thirds of the depth of the socket should be retained."

Question 2. ***"Do you believe in immediate replacement of the teeth by dentures, or do you allow some time to intervene between the removal of the teeth and the making of the denture. If so, how long?"***

Answers: Immediate replacement, 11; medium time (from 7 to 10 days), 13; long time (1 month to 6 weeks), 3; no answer, 3.

M.M. House: "This is a matter of health and general condition of the patient. Some cases immediately, others two weeks. Either is preferable to long edentulous periods."

Question 3. ***"Do you radiograph the edentulous mouth to determine the condition of the process, or to find if there are any roots or impacted teeth present?"***

Answers: Yes, 13; no, 2; as occasion demands, 9; no answer, 6. All quite favor it, but do not follow it up for financial reasons.

Question 4. (A). ***"Do you believe it is best to mount study models for full and partial-denture cases, and also bridge work, on anatomical articulators as an aid in diagnosis?"***

Answers: Yes, 20; no, 4; no answer, 6.

Geo. W. Clapp: "On this question, I should like to be very definite, purely as a result of observation. I have had the opportunity of seeing a considerable number of cases in which there were un-

detected contacts and stresses between opposing teeth, sometimes with serious consequences to the general health of the patient. After witnessing the benefits which have been conferred upon many patients by the study of models exactly taken and exactly mounted, I am very firmly of the opinion that study models for both partial-denture cases and also for bridge work should be mounted on anatomical articulator and given the most critical inspection of which the dentist is capable."

Question 4. (B). "Do you use anatomical articulators in the construction of your dentures, full and partial dentures, and bridge work? If so, what kind?"

Answers: Yes, 21; no answer, 9; articulators used—Gysi Simplex, 11; Hanau Model H, 11; Gysi Adaptable, 5; Hanau Kinescope, 4; Hall, 4; Munson, 3; Needles, 2; Gritman, 1; Wadsworth, 1.

The apparent discrepancy in numbers, is due to the fact that some men use several different types of articulators.

Question 4. (C). "Do you use the face-bow?"

Answers: Yes, 19; no, 3; no answer, 8.

Of the three who said, "No," two used the Hall articulator and one the Gysi Simplex. The technique of the Hall articulator does not call for the use of the face-bow and there is a method of using the Gysi Simplex articulator without the face-bow. The overwhelming consensus of opinion is that the face-bow is of the utmost importance in mounting both working casts and study casts.

Question 5. "In your periodontia cases do you use some form of splint? If so, do you use a fixed or a removable splint?"

Answers: Yes, 6—fixed, 2; removable, 4; no, 5; no answer, 19.

Most men did not answer. Evidently the question was not understood. We wanted to find out whether dentists were using dentures to support teeth weakened by trauma or pyorrhea, or whether they were using other forms of splints constructed for this purpose.

Question 6. (A). "What form of restoration do you prefer where teeth are lost? Do you believe the appliance should hold the teeth rigidly or do you believe it should allow movement? What type of attachment do you use?

Answers: Rigid appliance, 3; movable appliance, 14; no answer, 13. Type: Dresch, 5; Slotted, 4; Roach, 2; Piston and Cylinder, 1; Kale, 1; Ball and Socket, 1.

Russell W. Tench: "The form of restoration depends upon its position and size, and the function it is called upon to perform; also upon the length of the teeth to which the restoration is anchored, as well as upon the mobility or immobility of the teeth in their sockets. The health of the investing tissues is an important factor. Broadly speaking, where teeth are relatively immobile and the restoration is small, involving one or two teeth, fixed or semi-fixed appliances with porcelain tipped pontics are very satisfactory. In proportion as the teeth, to which the appliance must be attached, present a condition of mobility, I believe that the supplied teeth should be anchored by mobile attachments. For removable bridge work I favor an attachment of the Chayes type. For the partial dentures I use half-round wire clasps and Dresch No. 2 or Kayle attachments. In partial denture construction, when removable attachments are not employed, I use the half-round wire clasps, usually without the occlusal rest."

Question 6. (B). "Do you use resting lugs on your clasps and appliances (square, round, or hooked)?"

Answers: Yes, 12—square, 7; round, 7; hooked, 5; no, 1; no answer, 15.

The apparent discrepancy between those who answered yes, and the kind of lugs used, is due to the fact that some used two types of lugs.

Question 7. "Do you believe all pressure should be removed from the gingiva and if so, how do you prevent gingival pressure?"

Answers: Yes, 11—by clearance around the teeth, 9; by trimming away the impression, 2; no, 3; no answer, 16.

Question 8. *"Is the movable-removable bridge a success in your practice?"*

Answers: Yes, 6; no, 6; no answer, 18.

Question 9. (*A*). *"What method do you use in supplying a single lost tooth?* (*a*). *Anterior.* (*b*). *Posterior."*

Answers: (*a*) *Anterior teeth*—inlay, 8; Carmichael, 4; pin inlay, 2; partial plate, 1; clasps with porcelain pontic, 1. (*b*). *Posterior teeth*—inlay, 10; removable bridge, 5; clasp and saddle, 3; Boyle, 1; no answer 10.

Discrepancy here, in numbers, is due to the fact that some did not designate whether attachments were for anterior or posterior teeth.

Question 9. (*B*). *"Do you use porcelain roots, and what is the condition of the gums and sockets upon the removal of the appliance?"*

Answers: Yes, 7; no, 10; no answer, 13.

Those who answered "Yes" to this question said they used short roots well glazed, which prevented trouble. Most of those who said "No" found the gum in an unhealthy condition upon the removal of the appliance.

Question 10. *"What method do you use in taking impressions?"*

Answers: *Full impressions*—upper and lower: compound, 17; plaster wash, 7; negative-pressure technique of impression taking (Stansbury plaster wash modification), 3; plaster, 2; plaster and wax, 1. *Partial impressions*—sectional compound, 12; plaster, 12; plaster wash, 2; solvite, 2; complaster, 1.

Some used a number of different methods. Only the definite responses were tabulated.

A CONSIDERATION OF THE STRUCTURE OF THE ALVEOLAR PROCESS, WITH SPECIAL REFERENCE TO THE PRINCIPLES UNDERLYING ITS SURGERY AND REGENERATION[1]

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Since the illustrious John Hunter (1728–93) declared that "the alveolar processes of both jaws should rather be considered as belonging to the teeth than as parts of the jaws" (7), the general conception regarding that part of the maxillary bones has remained unchanged even to the present day. Dental literature abounds with such descriptive terms of the alveolar process as "transitory," "poorly nourished," "unlike true bone," "evanescent," "soft spongy," "absorbed in whole or in part," "separate and distinct bone from the remaining skeleton," etc. One gets little inspiration in preventive dentistry if he is convinced before he starts that the supporting structures of the teeth are incapable, on account of their inherent structural and developmental weaknesses, to employ the defensive mechanisms so effective in other more favored parts of the body. It seems that it is high time to stop and consider some of these misconceptions of the alveolar process, which too often underlie the so-called "principles" in many branches of dentistry.

The geographical boundaries of the alveolar process have never been defined. One recent book makes the statement: "There are no Haversian systems in the alveolar process proper" (8). More about Haversian systems later. But will these authors please answer this question: "Just how much of the maxillary bone comprises the alveolar process proper?"

In order to determine the nature of the alveolar process it would seem logical to compare its characteristics with the distinguishing

[1] Read at a meeting of the First District Dental Society of the State of New York, at the New York Academy of Medicine, October 5, 1925.

characteristics of other bones, as to structure, response to stimuli, and regeneration. If it compares identically in these then it follows that the diagnosis, surgery, and prosthetic replacement of this region must be founded upon the principles underlying the surgery of the bones in other parts of the body.

As an approach to this subject, it will be necessary to offer a new definition for that part of the maxillary bones popularly known as the alveolar process. The alveolar process may be defined as that part of the jaw bones which gives support to the teeth or their artificial substitutes. It is composed of compact and cancellous tissue arranged in its external contour and internal architecture to best meet the stresses transmitted during mastication. It may be further emphasized that the relation of opposing teeth, the length of the cusps, different degrees in the axial angles of the superior and inferior teeth, the influence of the accessory factors concerned in mastication, and all remaining factors, pathologic and otherwise, which may affect individual bones or the osseous system in general, are as indelibly imprinted on the structure of the alveolar process as are environmental influences on the head of the femur.

The following references regarding the structure, function, and development of cancellous bone in other parts of the body show that this type of bone has a basic similarity to the cancellous bone in the alveolar process: "Spongy bone is homogenous with compact bone as a structural material and differs from it mechanically only in possessing smaller strength approximally in proportion to its density as compared with compact bone" (2). Cancellous bone is found in those parts of the body where the chief function of the structure is to transmit tensile and compressive strains. For example, in the vertebral column the most efficient method of transmitting the weight of the head and thorax is by cancellous bone. In the vertebral column as in the head of the femur, "the trabeculae lie exactly in the paths of the maximum tensile and compressive stresses and hence these trabeculae carry these stresses in the most economical manner. This is in accordance with the well-recognized principle of mechanics that the most direct manner of transmitting stress is in the direction in which the stress acts" (3). In brief, that part of the alveolar process which is composed of cancellous bone is constructed in the strongest manner

with the greatest economy of material to best meet the varied forces occurring in mastication. The transition from cancellous to compact tissue around individual teeth presents a beautiful record of the changing types of stress to which each part is subjected.

"The thickness and closeness of spacing of trabeculae vary in bone directly with the intensity of the stresses transmitted by them" (4). Here is the physiological law which accounts for most of the varying densities in the dental radiograph. A single remaining molar bearing all the stresses of mastication is characterized by an increased closeness of spacing of trabeculae. Conversely, a decreased closeness of spacing of trabeculae is characteristic of lack of use, or disuse-atrophy of the part. These changes are not produced by infection or inflammation. Fundamentally they are changes in bone due to physiological stimulation or lack of it. To term these changes condensing osteitis is to confuse their origin. Changes in bone which are induced by physiologic stimuli are no more pathological than are the more pronounced tuberosities on the humerus of a laborer.

Thus it will be seen that it is impossible to determine the significance of cancellous tissue unless by a careful study of the history of the individual patient's habits of mastication. A comparative study of cross sections of jaw bones of modern and primitive man is a most instructive method of gaining a true conception of cancellous tissue. A study of this kind might alter some modern dental misconceptions, such as those relating to traumatic occlusion and alveolectomy.

In accordance with the law of bending stress, the body of the mandible in the molar region is hollow, the bone that forms the outer and inner plates being arranged with its mass at the greatest distance from the neutral axis. The periphery of the entire body of the mandible, including the part generally known as the outer and inner alveolar plates, is composed of compact bone. The alveolar plates contain all of the characteristic features of compact bone as found elsewhere. Histologically it is impossible to distinguish it from other compact bone except for certain peculiarities in the arrangement of the lamellae due to its development. Within this shell of compact bone the arrangement of the cancellous tissue is very interesting. To combat leverage the roots of the lower anterior teeth, in the region of the gingival and middle thirds, are encased labially and lingually in

compact bone in which Haversian systems are found throughout, even to the crest of the alveolar plates. In the region of the apical third, the roots are surrounded by hard cancellous plates, running in every direction, to combat the tearing and biting stresses peculiar to this area. Below the apices of the teeth the interval between the external and internal plates contains thick heavy cancellous plates, which bind together the external and internal plates in such a manner as to demonstrate undeniably their mechanical function. In the symphysis, which ties the halves of the jaw together, the bone has the character of the calcar femorale of the femur.

The arrangement of the bone surrounding the inferior bicuspid and molar teeth is decidedly different. Here the chief force is compressive, with some lateral pressure depending upon the depth of the sulci and the inclined planes of the cusps. In describing trituration or grinding, Pickerell says: "The lower jaw is drawn first outwards and next forcibly upwards and inwards, so that the lower molars grind on the upper molars in a lateral direction—namely, from without inwards" (6). The examination of transverse sections of these regions show the arrangement of the bone to be best suited mechanically to meet these forces. A study of the cancellous plates shows that the trabeculae lie in the path of compressive stresses. The tipping buccally of the lower bicuspids and molars, in the lateral excursion of the mandible, is prevented by the development of compact bone along the buccal surface of the roots, the remaining root surfaces being entirely surrounded by cancellous bone. The direction of the cancellous plates and the density of the buccal plates change after the cusps have been worn down, since there is a lessening of the tipping stress as a result of this occlusal wear.

The structural characteristics of the immovable upper jaw are quite different from those of the lower. Having no large muscle attachments it is comparatively free from bending stresses. Since the forces are chiefly compressive, the bone is mainly of the cancellous type to meet bending forces due to the axial angle of opposing teeth or depth of sulci. The transition from compact to cancellous bone in the superior incisor region is a beautiful example of the adaptation of bone to bending stresses through the addition of reinforcing lamellae to the interior of the Haversian spaces, resulting in the classical

Haversian canal. These Haversian systems are not so regularly spaced nor do they contain as many lamellae as those in the body of the mandible. In the superior bicuspid and molar regions the force from the lateral excursion of the mandible is met chiefly by the lingual plate, strengthened in turn by the arch of the plate. Compared with the buccal plate, the lingual plate is much more dense, thick, and has more of the characteristics of compact bone. It completely covers the lingual surface of the lingual root, the remaining roots of the tooth being served by cancellous bone.

The lamina dura, to judge from its importance, should be a structure designed for perfect nourishment and repair. This thin layer receives all the forces of mastication and transmits them to the surrounding structural framework. Histological sections made of the part show it to contain more bone cells than any bone tissue elsewhere examined. The cells are large and packed closely together. The canaliculi are a mass of interlacing branches. In spite of its comparative thinness, and the fact that it is nourished directly by the vascular pericementum, it is pierced by channels carrying blood in still closer contact with its myriads of cells. From the fact that other tissues are nourished in proportion to their function, the great importance of this lamina dura is thus further emphasized.

The conclusions of McEwen, in his comparatively recent researches in bone regeneration, are borne out by the so-called regeneration of the alveolar process following tooth extraction. When the tooth is extracted it is true that the alveolus disappears. But it does not disappear in the sense that its buccal and lingual walls absorb. Its disappearance is produced by the filling in of the socket with bone which has gone through the same formative changes that occur in the healing of a fracture. The oft repeated statement by the advocates of alveolectomy, that "only as much bone is removed surgically as that removed by Nature through absorption," is a myth. The incorrectness of the statement is in the misuse of the word "absorption" as applied to the changes that follow tooth extraction. A more scientific and descriptive expression for these changes would be the term "rebuilding." The region occupied by the alveolus is not filled in promiscuously with calcific material "without rime or reason," but is rebuilt through the agency of osteoblastic and osteoclastic elements

derived from the alveolar border and lamina dura, which withdraw and lay down bone in response to the influence of the "stresses to which they are subjected." Obviously the rebuilding process would be seriously interfered with, if the source of its formative elements were removed by the injudicious trimming away of the alveolar border. The observation, by roentgenographs, of the healing of a tooth socket over a period of months or years, following the changes from the ground glass appearance of the bone in the early stages to its later adult system of supporting trabeculae and compacta, which are "arranged parallel to the lines of stress," induces one to apply John Hunter's famous expression, "consciousness," to the alveolar process.

The clinical application of this short review of the behavior of osteoblasts in rebuilding the alveolus is directly applicable to that damnable operation specifically known as "external alveolectomy" which is rapidly becoming passé in spite of the perennial efforts of its various originators to revive it. In the following particulars the technique of this operation, as originally described, violates every known law of bone regeneration:

(a) The periosteal flap does not form bone. "It has no osteogenetic function" (5).

(b) The osteoblastic elements in the external plate and interseptal process are ruthlessly removed, thereby removing the source of the cells concerned in rebuilding the ridge form.

(c) By the removal of the interseptal bone and labial or buccal plates, the lingual plate is left unsupported to bear masticating stresses produced by the denture.

(d) The remaining cancellous tissue does not possess the regenerative power of the lamina dura and external plate, which are removed during the operation.

(e) Clinically, it is a failure.

This alveolectomy technique is not to be confused with the very commendable practice of smoothing sharp spicules, rounding roughened edges, and removing other points of irritation not vitally concerned with the rebuilding of the alveolar process. Nor does it preclude the correction of markedly overhanging edges of bone or the surgical treatment of alveolar deformities. These operations should be done in such a manner that the vitality of the subperiosteal bone

will be preserved, much as has been described so admirably by Dean of Seattle. The retention of small bits of bone intact with their periosteum is to be especially recommended, as these under favorable conditions develop into osteogenetic islands for the further rebuilding of the alveolar ridge. The real test of the operation comes not at the time when it is being performed, but in the successive years of the patient's masticating history.

In the surgery of the alveolar process it may be said as a corollary that he exercises the best surgical judgment who best practices conservation for regeneration. From clinical observation it may be said that the extent of regeneration of the alveolar ridge is dependent more upon the amount of the bone remaining after the extraction than upon any other factor. When part of the alveolar border is destroyed by disease, it is the best surgical judgment to conserve what is left with extraordinary care, in order to promote the greatest amount of regeneration of the alveolar ridge.

The interalveolar-plate technique, as described by the author, is the dental application of McEwen's researches upon the growth of bone. Briefly, it aims to prevent the removal of the alveolar process during the extraction of the tooth, thereby preserving the buccal and lingual walls for the support of the alveolar periosteum, which, in turn, acts as a matrix governing the contour of the future ridge. When the shape of the tooth roots or pathologic condition of the surrounding bone precludes this result, the alveolar plate should be separated from the tooth by a chisel, leaving the surgically fractured alveolar fragment intact with its periosteum. In the removal of fractured roots, operative interference should be confined to the spongiosa, in order to dislodge the fragment without injuring the walls supporting the periosteum. It is claimed for this technique that, by the conservation of all the osteogenetic elements entering into the rebuilding of the alveolar ridge, there is produced a "flat base with parallel buccal and lingual walls" (Hall)—the ideal base for the prosthetic restoration.

The removal of infectious material in the periapical regions of the teeth should be done with the same care and thoroughness, with conservation for regeneration as the guide.

It is an interesting observation that the alveolar process, after the

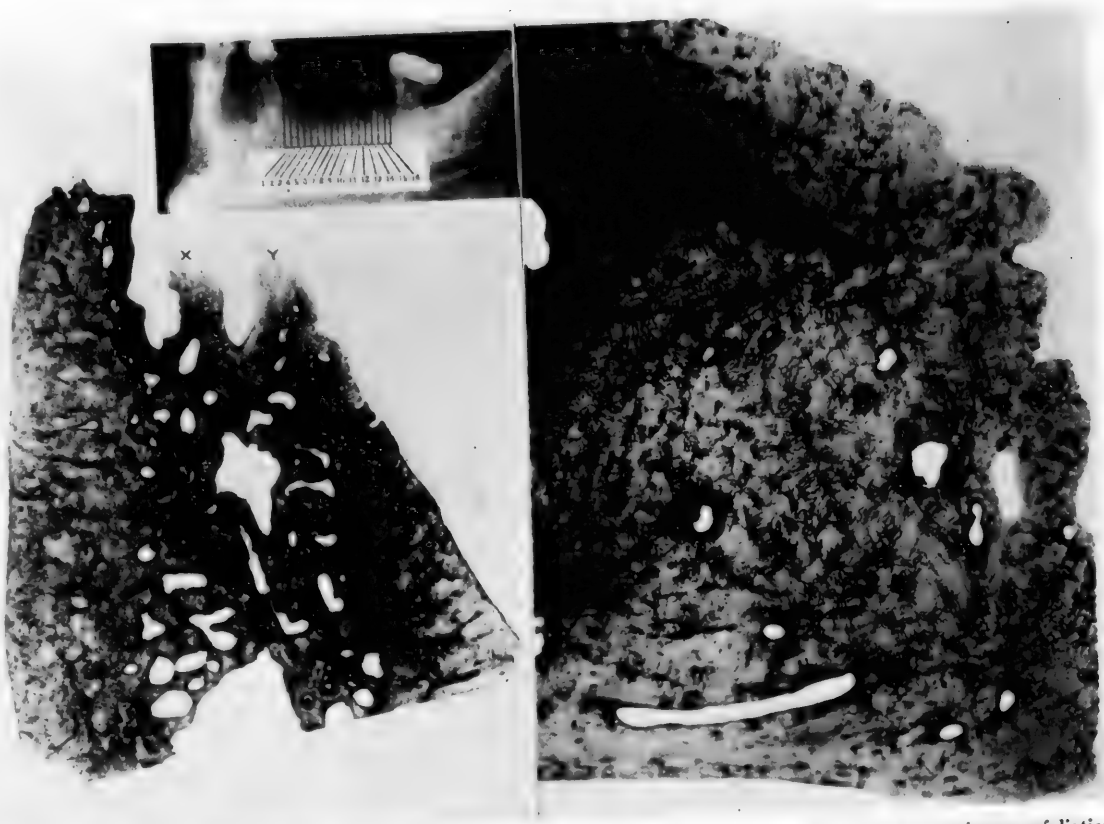

FIG. 1. The illustrations shown in *figs. 1-4* are ground sections of the rebuilt alveolar process, following extraction or exfoliation of the teeth. Note that all sections are taken from the superior edge of the alveolar border. The silver nitrate staining method, as shown in the illustrations, was perfected by Alphonse Lang, formerly with the Research Institute of the National Dental Association. *A*.—Section No. 4; see key figure (x23). *B*.—The lingual tip (x162) indicated Y, from section No. 4.

FIG. 2. *A*.—Section of alveolar border indicated by X in Fig. 1 (x162). *B*.—Enlargement of haversian system indicated by arrow in A (x540).

FIG. 3. *A*.—Section No. 7 (x23). *B*.—Field is indicated by arrow in A (x162). Note three haversian systems within a single trabecula.

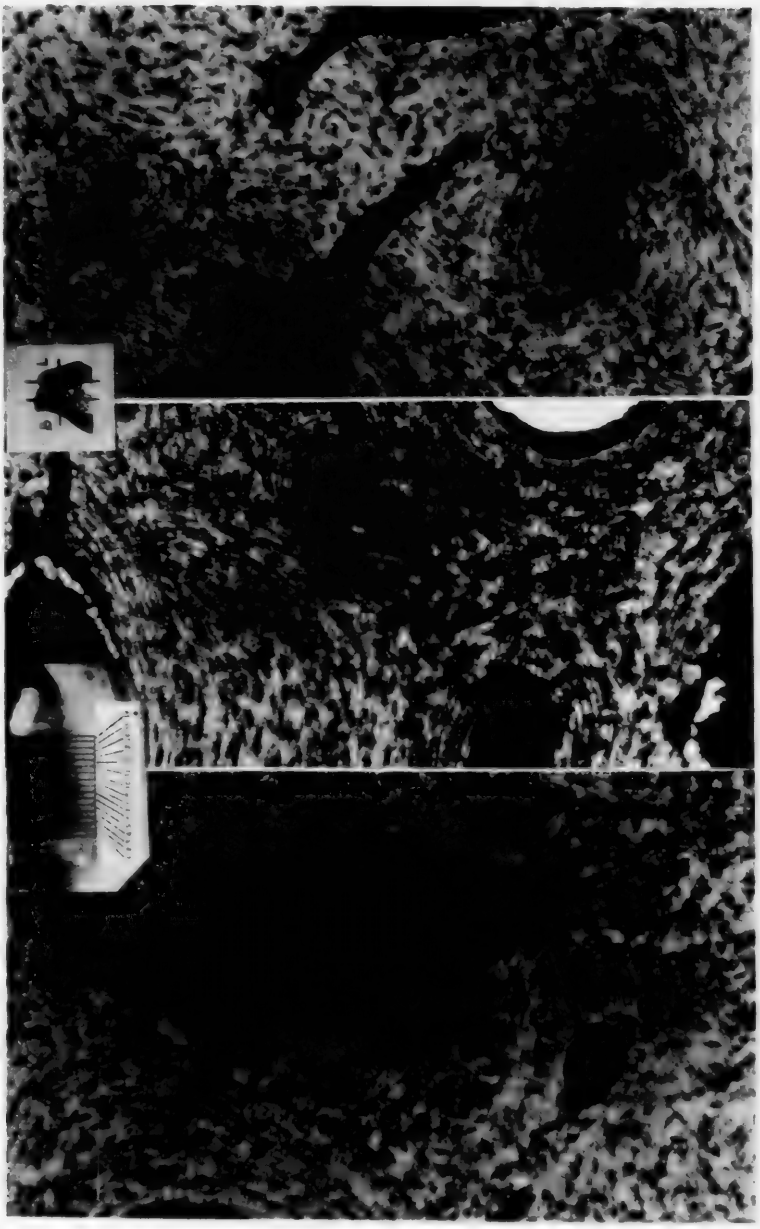

FIG. 4. Section No. 16 (x15½). The histological picture of "increased closeness of spacing of trabeculae." *A.*—Buccal section; *B.*—Center section; *C.*—Lingual section.

loss of the teeth, adapts itself under favorable conditions to the function of mastication. In several instances it has been observed clinically that the alveoli are not only filled with bone, but under the stimulation of the opposing teeth there has been an overgrowth of the alveolar border, which curiously enough takes on the shape of a flattened occlusal surface. The gum tissue over this area is very dense and cornified, and in appearance resembles somewhat the biting pad of the ungulata. In these cases the roentgen ray reveals a very dense alveolar border, which may be interpreted as "increased closeness of spacing of trabeculae" in accordance with the masticatory demands. Histological examinations of similar areas found at post mortem are characterized by the irregularity in number and location of the Haversian systems, and by the asymmetrical arrangement of their concentric lamellae. The relative position of the cancellous tissue and compacta is similar to that of the arrangement of the bone before the loss of the teeth, showing that the osteoblasts had built in response to stimuli which were received in the same direction as before the loss of the teeth. This response of the alveolar process to stimulation is similar to that produced by H. O. Thomas who, "by beating the external condyle of the femur with a mallet, made the bone cells build up a rampart which prevented the outward dislocation of the patella" (1).

Functional adaptation of the alveolar process has been observed clinically under artificial appliances which are constructed in such a manner that physiological stimulation is applied. Obviously it is impossible to report upon the histological findings, but, from digital and visual examination and by carefully directed roentgen rays, similar conditions are found which may be interpreted as having similar origin. It seems that there should be more attention given to appliances which would seek to create this functional response of the alveolar process.

CONCLUSIONS

1. The alveolar process has the fundamental histological characteristics of other bones.

2. In keeping with its functional requirements, it is abundantly nourished.

3. Conservation for regeneration should be the guiding rule in dental oral surgery through the use of the interalveolar-plate technique.

4. External alveolectomy violates all laws of bone regeneration.

5. The alveolar process has a very definite function after the loss of the teeth, and responds physiologically to the stimulation of artificial restorations.

6. In development, in response to stimuli, in regeneration, in any comparison with the remaining osseous tissue, there is no bone which is more characteristically *true bone* than the alveolar process.

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DISCUSSION

Milo Hellman, D.D.S. (*New York City*): The paper of the evening, as I interpret it, has a twofold purpose. One is to show the value of a more thorough knowledge of the nature and structure of the alveolar process, and the other is to recommend the application of this knowledge for practical purposes. The specialists in dentistry who are to profit most by this contribution, as I understand it, are the prosthodontists and the oral surgeons. As you are all well aware, I am neither a prosthodontist nor an oral surgeon. It would, therefore, be quite out of my range of experience to speak on the practical aspect of the paper. I am consequently obliged to base my remarks on the scientific phase of the subject, and hope that I may be able to amplify the principles involved, for the purpose of bringing about their better understanding.

My first remarks I shall make in the form of a criticism on the definition of "alveolar process," as given by the essayist. He states that "the alveolar

process may be defined as that part of the jaw bones which gives support to the teeth or their artificial substitutes." While such a definition would suffice from the viewpoint of the dentist, it will not fulfill the requirements from a more scientific aspect. Take, for example, that portion of the alveolar process present in the diastemata of the ungulates, which supports neither teeth nor artificial substitutes. What would you call it? And how about the alveolar process of such edentates as the Ant-eaters and Pan-

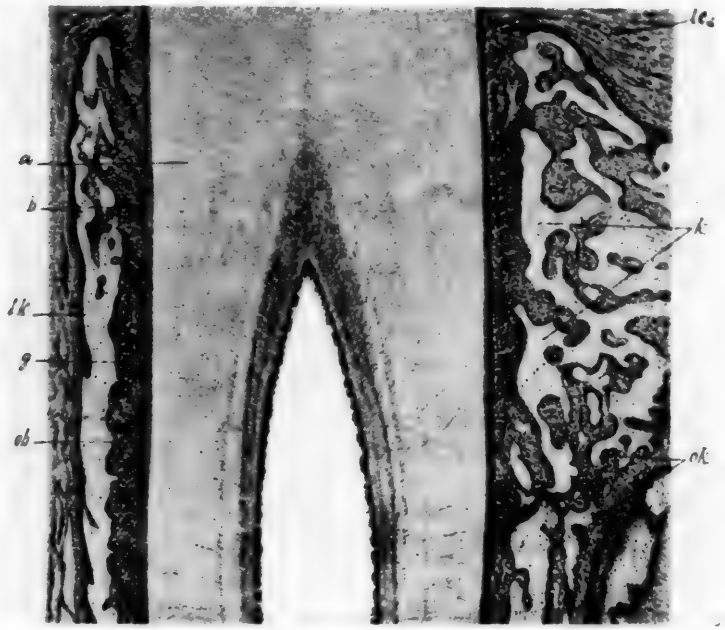

FIG. 5. Section through a normal tooth. *On the left labial side:* *a*—dentine; *b*—cementum; *g*—peridental membrane; *l.k.*—compact bone of lamellated structure; *ob*—osteoblasts; *l.c.*—dental ligament. *On the lingual side:* *k*—spongy bone; *ok*—osteoclasts.

golins, which have no teeth and do not use artificial substitutes? Even in mankind, there is a stage when the alveolar process supports neither teeth nor artificial substitutes, as in infancy before the eruption of teeth. What would the alveolar process be called then?

In regard to the nature of the alveolar process, that it is "separate or distinct bone from the remaining skeleton," it seems rather surprising that such notions still prevail. If they do, as the essayist contends they do,

it is certainly timely to call attention to their fallacy. In the light of our present knowledge, there is no evidence to prove such an assumption. On the other hand, there is an abundance of evidence from all sorts of investigation and experimentation, to furnish proof that the tissue constituting the alveolar process is true bone. The essayist has undoubtedly convinced you of this fact. But as there is some additional interesting evidence furnished by the experiments of Albin Oppenheim, of Vienna, I shall take this opportunity to show you a few slides that will verify some of the statements made by the essayist.

Referring to the nature of bone in general, one of the most prominent authorities on bone, Murk Jansen, of Leiden, says: "Bone develops, grows, and maintains itself in directions opposite to those in which body weight and muscle action strive to squeeze it together. The pressure stresses of function at the same time stimulate the growth and formation of bone. They constitute a trophic stimulus to bone tissue." What is true of bone tissue in general is also true of the bone tissue constituting the alveolar process. The only difference is that the bone tissue of the alveolar process, while not subject to the stresses of body weight or muscle action, reacts in a like manner to stresses of mastication under natural conditions. But when subjected to artificial stresses in experimentation, the reaction is somewhat different. The results of Oppenheim's experiments[2] may be cited to illustrate the kind of reaction obtained by pressure stimuli. These experiments were performed upon an old world monkey, the Baboon (Cynocephalus), by means of orthodontic appliances. The purpose was to find out in what way the bone tissue constituting the alveoli reacts when artificial pressure, such as is applied during orthodontic treatment, is brought to bear on the teeth in the attempt to move them in different directions. In this case a section of a lower incisor surrounded by a normal alveolus was made (*fig. 5*). Here the lamelated structure of the bone constituting the alveolus is to be clearly discerned. The bone spicules are arranged parallel to the long axis of the tooth. This being a section of young growing bone, there are also visible a number of osteoblasts as well as osteoclasts. Next a section (*fig. 6*) was made of an homologous area after the application of artificial pressure for forty days. We find now a complete transformation of the bone constituting the labial plate of the alveolus. The force exerted upon the tooth was in a labial direction. What is the effect? In the main, there is a reorientation of the bone spicules. Instead

[2] Oppenheim, Albin: "Tissue changes, particularly of the bone, incident to tooth movement." *Oesterreichisch-ungarische Vierteljahrsschrift für Zahnheilkunde*, 1911, IV; *The American Orthodontist*, 1911, iii; No. 2, October.

of being parallel with the long axis of the tooth, they are now vertical to it. They also assume more of the character of cancellous bone tissue, and are hardly calcified and profusely beset with cells (osteoblasts) both on the side toward the tooth as well as on the opposite side. Also osteoclasts are seen, but they appear singly or isolated. Thus while there is both bone resorption and bone deposition, there is a preponderance of the latter.

This picture is completely changed when the same experiment is repeated, but with the amount of force greatly increased (*fig. 7*). In this case the reaction is entirely different. The bone itself gives no evidence of a response to the stimulus. It assumes an eburnated appearance, there being no resorption nor deposition areas; the blood vessels are thrombosed; the bone cells, though present, are inactive. The thrombosed blood vessels in this slide well illustrate the abundance of vascular supply.

On the lingual side of the alveolus of the tooth, which is being moved lingually, the effect of mild pressure is expressed by the orientation of the bone spicules vertically to the long axis of the tooth (*fig. 8*). But in this instance, the deposition of bone is on the tooth side where the spicules are surrounded by uncalcified zones and densely beset by osteoblasts. The effect of pressure on the labial side differs from that on the lingual. In the former, deposition of bone takes place at the end furthest from the source of pressure, while in the latter, at the end nearest to it.

Thus we have to agree with Jansen's contention that the effect of normal stress on bone is trophic, promoting growth and maintenance. But it must not be forgotten that there are some instances when this does not hold true. The bones of the cranium are an example of those bones which develop independently of or even before the action of pressure. Also an extremity affected by infantile paralysis and totally deprived of all muscle action and weight-bearing throughout life will retain all bone elements, although it may lag in development and growth. We must therefore admit that, although much is known about bone, there is still a great deal to be learned. We

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FIG. 6. Labial movement; *labial side:* at *ob*, near the alveolar border, the compact bone has disappeared and is replaced by spongy bone, with orientation of the spicules vertically to the long axis of the tooth. Between *G* and *ok*, transitional zone. *a*—dentine; *b*—cementum; *g*—peridental membrane; *G*—bloodvessels; *l.k.*—compact bone of lamellated structure; *ok*—osteoclasts; k^1—newly formed bony spicules beset with osteoblasts (*ob*); k^2—remains of compact bone that has lost the lamellated structure.

FIG. 7. Labial movement; *labial side:* application of intense force. The compact bony plate, *k*, throughout somewhat attentuated; no architectural reconstruction; all vessels of the peridental membrane, *G*, filled up with homogeneous masses (thrombosis?). *a*—dentine; *b*—cementum; *g*—peridental membrane; *ob*—osteoblasts in sporadic layers.

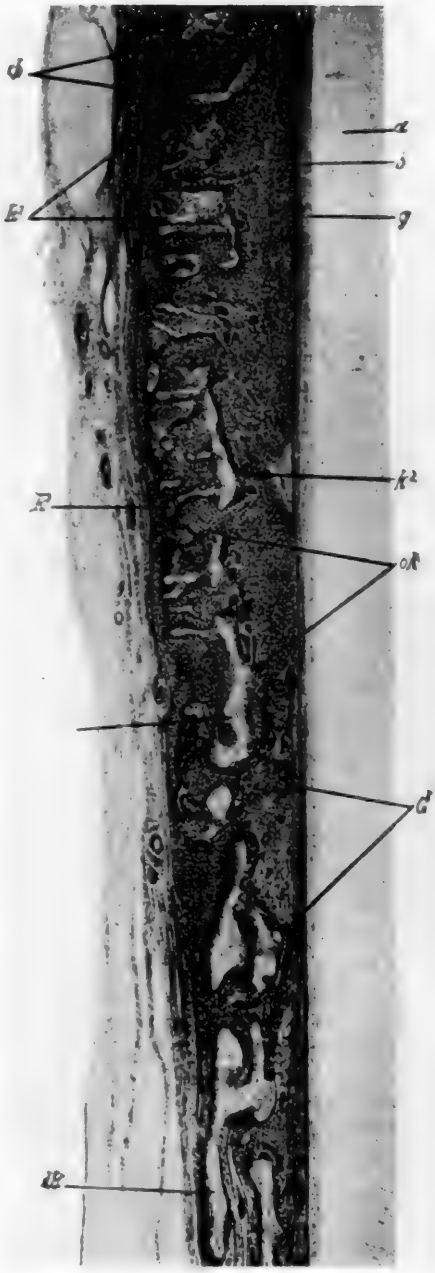

Fig. 6

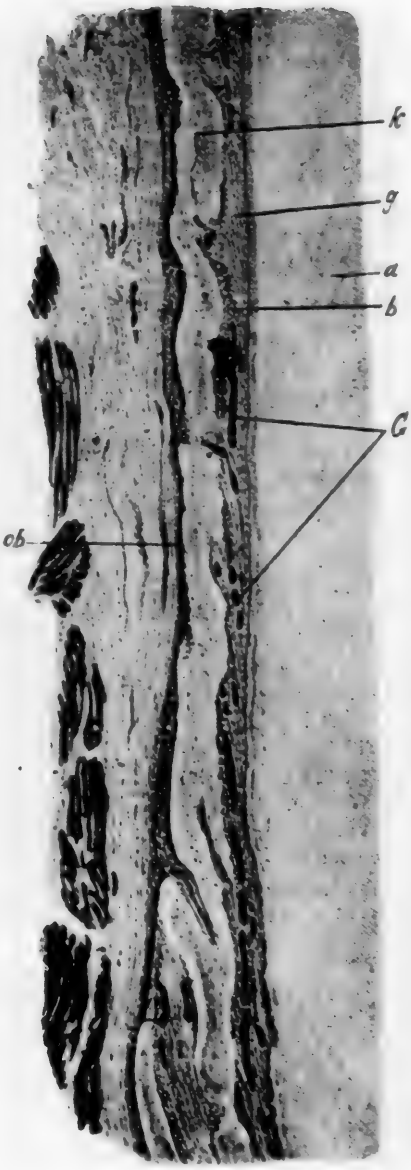

Fig. 7

must be wary of this fact and keep an open eye as well as an open mind, watching the future for a more complete solution of this problem. One thing is quite certain. The cells responsible for formation and modification of bone are the same kind wherever bone is present. The product of their activity is bone. The texture of bone may be different in different regions of the body, or it may be different in the same region at different times, but the fundamental fact must be remembered, that the product of osteo-

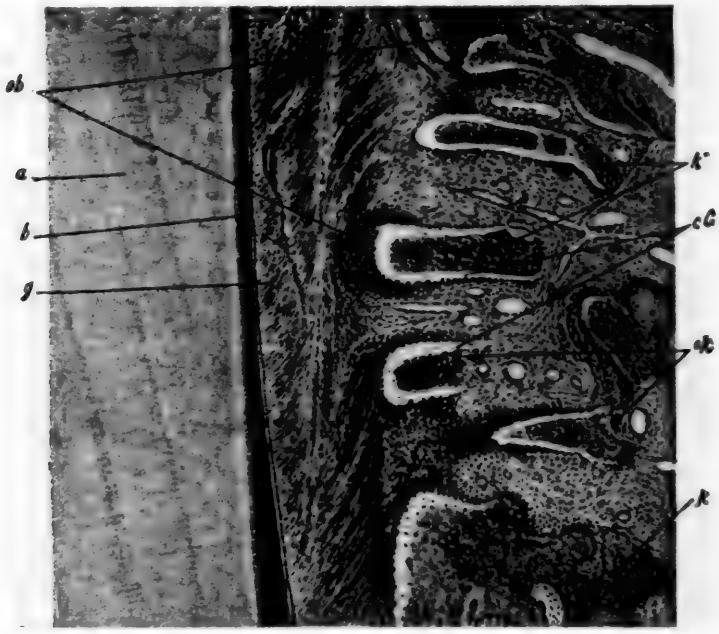

FIG. 8. Lingual movement; *lingual side:* near the alveolar margin the bone spicules, k^1, are arranged in the direction of the force; surrounded by uncalcified zones, *o.G.*, and densely arranged rows of osteoblasts, *ob*. *a*—dentine; *b*—cementum; *g*—peridental membrane; *ok*—osteoclasts; nearer to the apex of the root, old unchanged bone—*k*.

blasts is bone and that bone produced by osteoblasts is the same regardless of whether it constitutes the head of the femur or the alveolar process.

Milton Cohen, D.D.S. (New York City): The prosthodontist, when called upon to discuss this paper, finds it necessary to consider the problems involved, not only as they relate to the alveolar process, but also as they concern the overlying tissues. In other words, the condition of the soft

tissues must be studied quite as carefully as the hard tissues in planning a satisfactory substitute for lost dental structures. When the radiographs show physiologically sound bone, the macroscopic appearance of the mucosa and the conclusions drawn from by palpation have been the only guide-posts seemingly needed for diagnosis, prognosis, and restorative treatment. Assuming, however, that upon the bone is dependent the length of service of the case, this question appears logical: "Why have we neglected to give this important factor proper attention?"

It seems that very little information concerning the changes in the alveolar process has been given to the prosthodontist. Shrinkage or physiological absorption is seldom discussed in our meetings and rarely considered by the individual. In other words, readjustment to later conditions is assumed as a natural course of events, without valuing pre-determining factors or causes. There is here a weak link in an otherwise earnest attempt to apply scientific principles. The responsibility must rest upon those research-workers who are interested in bone-study. I think, therefore, that this society has shown rare good judgment in seeking to stimulate thought along this line. And we are to be congratulated for our good fortune in having with us Dr. MacMillan. He has brought out many interesting points that warrant clinical attention and study, and it seems impossible to disagree with his conclusions until there has been created an opportunity for such study. At present, we can only say that his views seem very discordant with what has been accepted in the past, particularly in regard to physiological stimulation of bone with artificial substitutes. I have several slides showing a type of restoration which is supposed to give tissue stimulation as far as dental science can at this time accomplish it. But the idea of inducing bone-growth through the action of external forces is somewhat beyond what I feel most of us can accept at present. I should like to ask Dr. MacMillan to elucidate the following two points: (1) Can the alveolar process be stimulated to prevent shrinkage? (2) How can this be accomplished without causing a pathologic condition of the overlying mucosa? Whatever the answer to these questions may be, if Dr. MacMillan's paper stimulates histologists to study the alveolar process as to the reasons for physiological absorption and the means of preventing this condition, this meeting will have been an epochal one. I want to express my thanks to the essayist for his splendid paper and sincere efforts in a very difficult branch of scientific research. (Dr. Cohen then showed several slides of prosthetic appliances.)

Dr. MacMillan (in conclusion): In closing may I express my appreciation to the First District Dental Society for their interest in the afternoon clinic

and the paper this evening. Especially am I indebted to the discussors as their lantern slide demonstrations prove that they have spent considerable time in preparation. In addition to credit given in the bibliography, the work of Noyes and Dewey should receive special commendation.

It has been very interesting to review again the work of Oppenheim as demonstrated by Dr. Hellman. Unfortunately the illustrations were artist's drawings instead of the actual microphotographs. This work could be repeated with profit especially on older animals. The effect of age on supplemental growth and rebuilding of bone has not yet been satisfactorily answered. It seems to me that the orthodontic patient is often dismissed at the most interesting stage of his treatment. If I were practicing orthodontia I believe I should never dismiss a patient. A radiographic record of the bone changes in the years following the regulating would be intensely interesting. Careful records of this kind would add more to the knowledge of orthodontia than animal experimentation.

A paper of this type would not be complete without reference to the effect of exercise on the development of bone as described by Howell (An experimental study of the effect of stress and strain on bone development: *Anatomical Record*, 1917, xiii, no. 5.)

The application of the principles underlying the deposit of bone in the alveolus following extraction has been very beautifully carried out by Dr. Cohen in his type of restoration, which physiologically stimulates the alveolar ridge. Personally I can not see any particular advantage in massaging or stimulating a part of the mouth not directly concerned with mastication, as the projections of his appliance massage the mucosa over the palatine arteries. However, the Chayes appliance has clinically proven that the alveolar border has a very definite function following extraction, and responds to the stimulating impact of the correctly constructed prosthetic appliance. The beautiful contour of the alveolar ridge observed after wearing these appliances proves clinically that the term "evanescent," as applied to the alveolar process by some exodontists and prosthetists, should be somewhat qualified.

A SYSTEMATIZATION OF THE CLINICAL STUDY OF FOCAL INFECTIONS[1]

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There has been much research in the past decade, which has gone far toward establishing upon a sound basis the theory of focal infection and resulting secondary lesions. Most of the investigation in this field has been pursued in the biochemical and bacteriological laboratories, with the resulting promulgation of the theory of selective localization.

The study of pathology depends upon a knowledge of anatomy and physiology. Detailed study of the relation of disturbed function to altered structure has given us our fundamental conception of pathology. This has been done so completely in the bacteriological laboratories, with the aid of animal experimentation, that the focal infection theory seems fundamentally sound and acceptable. The fact that the etiology now seems clear, in many cases previously thought to be idiopathic, would indicate that the next step in progress must be made through the channels of clinical experience and close observation at the bedside. This must be based upon the fundamentals of internal medicine, and becomes a study of the symptomatology of disease in its relation to clinical pathology. It must include a study of an extended series of carefully selected cases, fully recorded in a systematized tabulation. This is indeed a problem calling for the closest coöperation between the medical and dental professions.

While much space has been devoted to the subject of focal infection in the form of reports of medico-dental cases, the presentations which attempt to show cures or failure to cure have been lacking in scientific background. This is due to the incompleteness of histories and their lack of correlation with the clinical pathology of the case. The failure

[1]Read at a meeting of the New York Section of the International Association for Dental Research, Columbia University Club, New York City, March 2, 1926.

to devote sufficient consideration to the post-discharge follow-up is also a universal deficiency. Most of the reports submitted have been practically worthless because an unbiased analysis of them, leading to a scientific conclusion, has not been possible. This demonstrated inadequacy of the records is undoubtedly due to the lack of a systematized routine manner of recording the facts.

For some years the authors have been cognizant of this deficiency in case-record reports, and have sensed the importance of having available, on one hospital form, complete data bearing upon the relation which may exist in a given case between the presence of primary dental foci and the occurrence of secondary systemic infections. With this in mind we have developed a dental-medical research chart, and have initiated it into use as part of the system of records in our study of these cases in the Oral Surgical Service of the Fifth Avenue Hospital in New York City. The authors hope that a contemplated report of the details and statistics of a series of cases studied in this manner may prove of some clinical value.

The research chart is a four-page folder, having at the top of the first page the standardized heading of general information common to all of the forms in use at the Fifth Avenue Hospital, under which a brief space is devoted to the history of the oral condition. Following the history appears a diagram which shows the relation of the full set of teeth of the upper and lower arches. This depicts the relation of the teeth to the surrounding structures of importance. In the mandible the inferior dental canal and the mandibular foramena are shown. Both rami appear and the relation of the condyloid process of the mandible to the glenoid fosa of the temporal bone is clearly represented. In the maxilla the diagram shows both maxillary sinuses and their relation to the teeth. Shown also are the nasal fosa with septum and turbinates, the orbits and the position of the infraorbital foramena. Upon this diagram may easily be sketched and well represented any common condition of oral pathology that a case may present. The remaining portion of the first page is devoted to oral pathology. This section of the chart is so tabulated that a simple checking system records the pathological findings. The degree of deposition of salivary calculus and the condition of the periodontal tissues are checked. Periapical pathology is outlined in its successive

stages. Tabulation is made of the condition of any root canal fillings. Checking provision is also made for the common dental anomalies. (*Figs. 1* and *2*.)

The second page records maxillo-facial pathology and pathology of the related parts. Bacteriological and pathological examination reports and any major x-ray reports also appear on this page, followed by the recommendations for dentistry or oral surgery. Provision is made at this point for the expression of an opinion based upon the foregoing data as to whether the oral pathology is probably an etiological or an aggravating factor in the patient's general condition. (*Figs. 3* and *4*.)

The third page starts with a brief summary of the treatment which the patient has received in the Department of Oral Surgery. Notations are made as to the nature of the operations and any pathological findings. This affords a direct checkup upon the previous diagnosis appearing on the chart under the heading of oral pathology. Next is given a history of other possible foci of infection that may coexist and be coresponsible for any primary or secondary manifestations present. Considerable space is reserved for a summary of the general medical or surgical treatment that has been instituted within the period during which the case has been under observation. This seemed to be a particularly important provision, in order that a logical conclusion might be drawn as to whether or not the removal of the infected teeth alone has effected a cure or an improvement in the patient's general condition. Space is reserved for a description of any exacerbation following operations, and for any general medical treatment instituted for it. At the foot of this same page there are the usual notations of the patient's condition at the time of discharge, and space is allotted for post-discharge observations. (*Figs. 5* and *6*.)

The fourth page is arranged entirely for the patient's general history. It is divided, according to the standard method of history taking, into chief complaint, family history, past history, history of present illness, and physical examinations. Following the general history are the tabulations of progressive urinalyses, blood counts, blood chemistry examinations, and additional space for any other data of clinical pathological value. (*Figs. 7* and *8*.)

The preparation of this chart has resulted from the study of many

FIFTH AVENUE HOSPITAL
DEPARTMENT OF ORAL SURGERY
RESEARCH CHART

Date _____ Oral Surgery No. _____

Name _____ Med.-Surg.-Pre-Natal-Eye-Ear-Nose and Throat-Diseases of Children

Address _____ (Room) (Bed)

Occupation _____ Class Service Pay-Free-Endowed

Diagnosis _____ Private / Staff / Private Staff } Case of { Dr. / Dr.

Admission No. Discharge No.

M. S. W. Race Age Date and place of birth

HISTORY OF ORAL CONDITION

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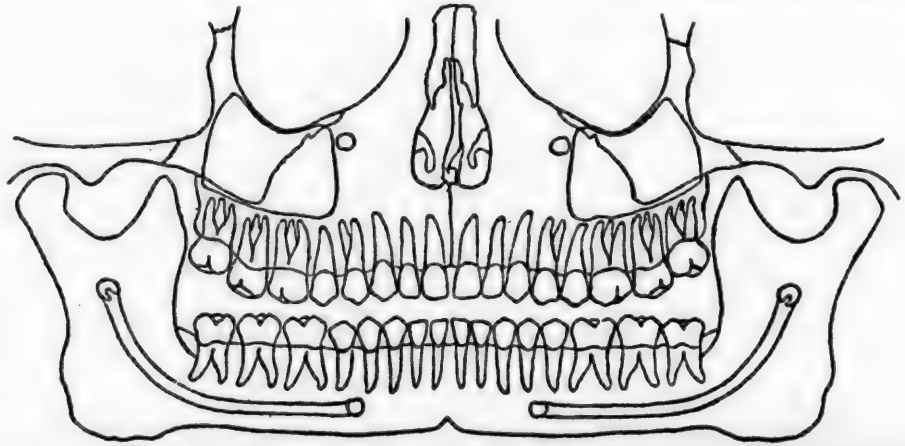

1

FIG. 1. RESEARCH CHART: UPPER HALF OF PAGE 1

ORAL PATHOLOGY

Deposition of Salivary Calculus

Light Heavy

Periodontal Pathology

- Gingivitis
- Chronic Suppurative Pericementitis
- Vincent's Infection

Periapical Pathology

- A—Acute
  - Dento-alveolar abscess
- B—Chronic
  - 1—Proliferative Pericementitis
  - 2—Rarefying Osteitis
    - (a) Granuloma
    - (b) Suppuration
    - (c) Cyst

Missing Teeth

Occlusion
- Poor
- Fair
- Good

Oral Hygiene
- None
- Moderate
- Good

Other Pathology

Pulpless Teeth and Roots

Root Canals
- Unfilled
- Partially filled
- Well filled
- Filling Projecting
- Perforation

Fractured Roots

Excementosis

Pulp Stones

Alveolar Absorption

Septal Necrosis

Impacted and Unerupted Teeth

Malposed Teeth

Supernumerary Teeth

Irritation from
- Filling
- Crown
- Denture

Crowned Teeth
- Gold
- Porcelain jacket
- Dowel attachment

Extensive Dental Caries

2

FIG. 2. RESEARCH CHART: LOWER HALF OF PAGE 1

MAXILLO-FACIAL PATHOLOGY

Ankylosis	Neuralgia
Cleft Palate and Cleft Lip	Necrosis
Cysts	Osteomyelitis
Radicular	Ranula
Follicular	Sinusitis
Fractures	Maxillary Sinus
Leucoplakia	Transillumination
Neoplasms	Right Left
Fibroma	Frontal Sinus
Sarcoma	Others
Carcinoma	Syphilitic lesions
	Tubercular lesions

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PATHOLOGY OF RELATED PARTS

Tonsils		Mucous Membrane
Glands 1—Salivary	Parotid	Tongue
	Sublingual	Floor of Mouth
	Submaxillary	Cheeks
2—Lymphatic	Sublingual	Lips
	Submaxillary	Palate: Soft
	Deep Cervical	Palate: Hard
	Others	Uvula

3

FIG. 3. RESEARCH CHART: UPPER HALF OF PAGE 2

SPECIAL X-RAY EXAMINATION

BACTERIOLOGICAL EXAMINATION

Date	Area	Smear or culture	Report	Vaccine

PATHOLOGICAL EXAMINATION

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Oral condition is probably an aggravating / an etiological factor in the patient's general condition.

RECOMMENDATIONS.

Prophylactive — Medication

Restorative — Diet

Surgical

Opinion of the attending physician as to the etiological factor in the patient's general condition.

4

FIG. 4. RESEARCH CHART: LOWER HALF OF PAGE 2

SUMMARY OF TREATMENT

Date	Operation	Pathological Findings	Anes	Remarks

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OTHER POSSIBLE FOCI OF INFECTION

Tonsils — Gastro-intestinal

Accessory Sinuses — Genito-urinary

Other Medical or Surgical Treatment Instituted within the time of this study.

5

FIG. 5. RESEARCH CHART: UPPER HALF OF PAGE 3

EXACERBATION FOLLOWING OPERATION

Date	Nature of the Exacerbation	Time of Onset	Duration

GENERAL MEDICAL TREATMENT FOR THE EXACERBATION

1—Prophylactive

2—Postoperative

3—Results

Case Completed Case Discharged Date to Report

Result at time of Discharge:

Cured - Improved - Relieved - Unchanged - Unimproved - Died

Follow-up Observations:

Final Results:

6

Fig. 6. Research Chart: Lower Half of Page 3

GENERAL HISTORY

Chief Complaint

Family History.	Tuberculosis	Cardio-vascular disease	Diabetes
	Malignancy	Lues	Insanity
Past History.	Scarlet fever	Measles	Influenza
	Diptheria	Rheumatic fever	Pneumonia
	Typhoid fever	Chorea	Venereal

History of Present Illness

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Physical Examination

URINALYSIS

Date	Amt.	React	SpGr.	Alb.	Sug.	Casts	RBC	WBC	Epith	Acetone	Diacetic Acid	Ind.	Bile	P. S. P. 1 Hr.	P. S. P. 2 Hr.
7															

FIG. 7. RESEARCH CHART: UPPER HALF OF PAGE 4

BLOOD COUNTS

Date	Coag Time	Hgb.	Ind.	R. B. C.	W. B. C.	Pn.	Lymphocytes			Tran	Eson	Baso.	My.	Morphology
							LL	SL	LM					

BLOOD CHEMISTRY

(Mg. per 100 Cc.)

Date	N. P. N.	Urea N.	Creat	U. Acid	CO_2	Sugar	C. F. T.	Remarks

Blood Pressure

Date	Diast.	Syst.

Basal Metabolic Rate

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FIG. 8. RESEARCH CHART: LOWER HALF OF PAGE 4

hospital charts from various sections of the country. Therefore complete originality cannot be claimed by the authors for all of the contained classifications and tabulations. However, it is possible to record facts on this chart under several headings which have not been found combined in any of the other charts that we have studied.

The various factors essential to a complete history have been arranged in a logical and systematic order so that all of the facts which may be considered as playing a rôle in the general condition of the patient may be studied with facility. Simplicity in arrangment has been attempted so that the records may be more readily reviewed for statistical data.

We hope that this chart may stimulate the development of other and more valuable charts, thereby adding impetus to the study of clinical pathology in its relation to the subject of focal infections.

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